The Electrical Industry's Weekly Magazine September 25, 1961

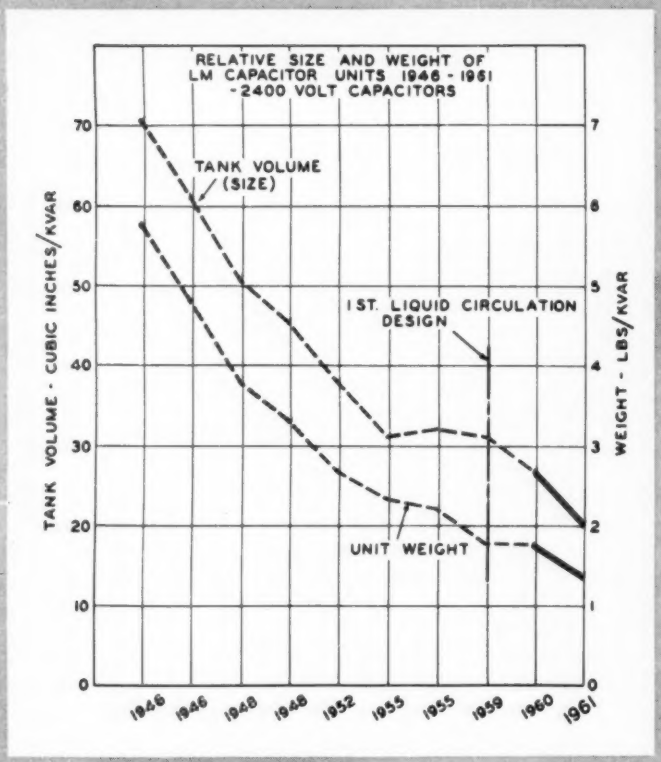
Electrical World

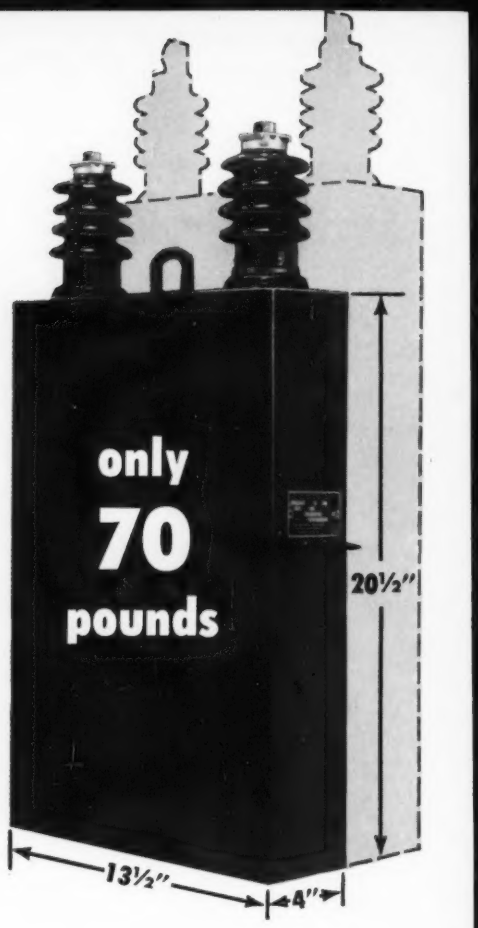
Price 50 Cents

A McGraw-Hill Publication

Squeeze 115-Kv Line Into 40 Ft. Right-of-way...

...page 42





ABOVE GRAPH SHOWS THE STEADY REDUCTION in relative size and weight L-M has made in capacitors throughout the years. A result of L-M's continued research and development programs backed up by expensive test facilities. The latest product, L-M's new Form 6, 50 kvar capacitor, is 17% smaller and 23% lighter. These new capacitors require less space to store, less effort to handle in warehouse and truck. Linemen will find them easier to handle and hoist.

L-M's New Lightweight 50 Kvar Capacitor Assures Ease In Handling and Installation

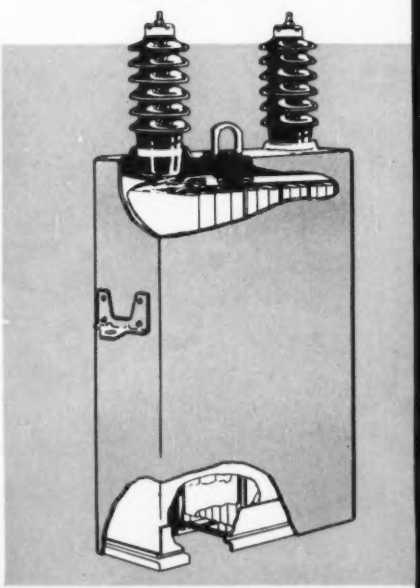
Exclusive cooling methods developed by L-M permit a smaller tank, less Elemex cooling liquid for this lightweight unit.

Line Material announces the new Form 6, 50 kvar capacitor. Another outstanding product of L-M's research and development facilities! This new unit has been greatly reduced in overall size and weight, making it much easier to store, handle, and install.

L-M's exclusive cooling method makes possible this phenomenal reduction in weight and size of Form 6 capacitors. This L-M development permits the circulation of Elemex liquid between and around the packs. Heat generated within the capacitor is carried to the radiating surface of the stainless steel tank. Heat is dissipated more rapidly. The capacitor remains cooler internally even though it is smaller.

Get Complete Information

Have your L-M Field Engineer give you complete details on this new L-M lightweight Form 6, 50 kvar capacitor. Or write Line Material Industries, Milwaukee 1, Wisconsin.



CORRUGATED SPACERS between capacitor packs circulate Elemex liquid eliminating capacitor hot-spots. Heat is quickly transferred to the stainless steel tank walls permitting radiation to surrounding air.

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527

Elemex® Capacitors

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Published for 87 years for those engaged in the business of generating, transmitting, distributing or applying electric power

Electrical World

September 25, 1961
Vol. 156, No. 13

Dateline . . .

Udall Comment on EEI Plan Raises Questions

New York, N. Y.—Comments of Interior Secretary Stewart Udall on the Edison Electric Institute plans for country-wide transmission interconnections brought sparse and cautious comment from industry sources last week.

The Udall statement (EW, Sept 18, p 99) was made in response to an inquiry from *Electrical World*, but released to all newspapers last week.

One industry source mirrored a general reaction, "Mr Udall seems to be putting some words in our mouth in his apparent effort to commend our efforts."

There was the distinct feeling that the Interior Secretary was seeking to interpret the EEI interconnection plan to better suit his own plans and purposes.

From the strictly factual viewpoint, there seemed to be wide discrepancy between Udall and investor-utility sources as to the function and scope of the joint EEI-Interior committee mentioned in the Udall statement.

According to Udall, "In recognition of the Department's responsibilities in power interconnection and pooling, I appointed a committee in April of this year to join with representatives of the Edison Electric Institute to study these possibilities with special attention to the economics and the advantages of extra-high-voltage transmission. I am hopeful that this committee can now be activated fully and assume its responsibility in this important field of resource planning."

According to investor utility sources, the scope of this committee was limited strictly to a study of voltage standardization for EHV transmission. It was definitely not set up to discuss the broader field of economics and advantages of interties.

Although both Interior and EEI have appointed members to this committee, there has been no formal meeting. Such a meeting has been postponed, it was said, pending action by an American Standards Association Committee on EHV standardization.

But the question posed by industry sources is, "Does Udall's public statement indicate that he is

(*Continued on page 5*)

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THE FINAL QUALITY TOUCH—Using Okonite "Cable-Matched" tape . . . a workman completes the job at the termination. Okonite quality splicing materials make splices and terminations as reliable as the cable.

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The MINIMUM in long-term cost

The Mead Corporation, one of the world's largest paper manufacturers, has used Okolite insulated cables for many years. The expanding Okolite cable system at their main mill in Chillicothe, Ohio opens the way to greater production capacities to handle an increasing market demand for Mead paper products.

There are many unique factors about the Chillicothe mill. To begin with, the plant is completely dependent on well water for its operation. Any failure in the pumping equipment means an immediate shutdown. To secure the maximum in circuit security and to obtain installation economies, the cable was buried at the same time new water pipes were being laid. Okolite-insulated cables—a 15kv cable for a 2½ mile main circuit and 5kv Okolite cable for two feeders linking transformers and pumping stations—helps to assure the trouble-free service so necessary for Mead.

The Okolite insulated cables installed at Mead were manufactured by the strip process to guarantee perfectly centered conductors and years of optimum circuit security. Find out what Okonite Cable'bility* can mean in reducing the long-term cost of your own vital installations. For complete details write for Bulletin EW-1085, The Okonite Company, Subsidiary of Kennecott Copper Corporation, Passaic, N. J.

*Cable'ability . . . cable craftsmanship since 1878

***where there's electrical power . . . there's* OKONITE CABLE**

Dateline . . .

New York, N. Y. (*Continued from page* 3)
now ready to broaden the scope of the joint committee?"

The Interior Department could not give an immediate answer to that question last week. The intentions behind the Udall statement may be spelled out in private conferences more appropriately than in public print. Industry leaders appeared in no hurry to rush into this discussion until they had sufficient time to consider the full implications of the complete statement.

There would certainly be some men in the industry who would be reluctant to speedily broaden the functions of the committee along the lines suggested by Udall. These men think that the Interior Department under Udall would use such a committee to foster federal power encroachment as has been spelled out in policy statements from Interior and the White House.

There has been too much talk of "Giant Federal Grids" for investor company executives to be enthusiastic about Udall's suggested functions of the joint committee.

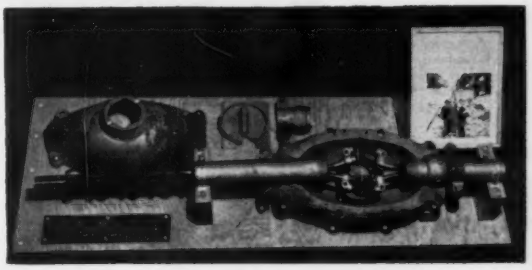
If Udall is bent on broadening the functions of the committee, he will have to negotiate such changes with EEI, and that may take more reassurances of sincere cooperation than have been made so far.

Industry sources were not inclined to argue the factual basis of other comments made by Udall, but they felt that he had twisted their announcement to make it appear to be a part of some overall Administration activity.

Investor utilities as a group have never adopted the "common carrier" philosophy which has been stressed repeatedly in power policy statements by Interior. There are other statements in the Udall comment with which the utilities will take issue.

For the moment, they are willing to savor the few words of praise in the Udall comment.

Letters



Confirms History of Ac Development

To the Editor:

It appears from the record that the first ac network of the type discussed in Mr Parker's letter (EW, Sept. 4, p 5) was installed in St. Louis sometime before 1898.

This may be verified by reference to an article, "The Missouri-Edison Electric Co of St. Louis and Its Development of the Alternating-Current System for Light and Power Distribution" (*Electrical Engineer,* June 9, 1898, pp 629-648).

On page 645 of that article, the author states: "In the underground distribution, high potential is used only on feeders; the entire system of mains being designed for 220 v, three-wire. This portion of the system is almost identical in detail with that used by the large stations operating the Edison three-wire, direct-current system. The usual form of Edison tubing consisting of iron pipe enclosing three copper rods separated by an insulating compound, is used very extensively. The system of mains forms a complete network passing along and connecting almost every street."

As a matter of interest, a recent photograph of a typical section of Edison tube and joint is enclosed (see above). Note that the conductors are copper rods spaced and held together by rope. The 20-ft lengths of iron pipe were then filled with pitch. The joints were made up and insulated in the field.

Andrew Bodicky
Ren Beatty
St. Louis, Mo.

ELECTRICAL WORLD
Vol. 156, No. 13 September 25, 1961

Published weekly by McGraw-Hill Publishing Co., Inc., James H. McGraw (1860-1948), Founder. **Executive, Editorial, Circulation and Advertising Offices:** McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y.

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United States and possessions subscription rate for individuals in the field of the publication $6.00 per year; Canada $7.00; single copies 50 cents. Other Western Hemisphere and the Philippines $20.00 payable in advance and other countries $30.00 payable in advance.

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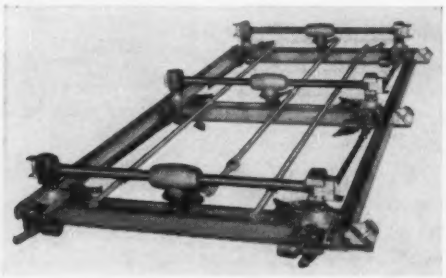
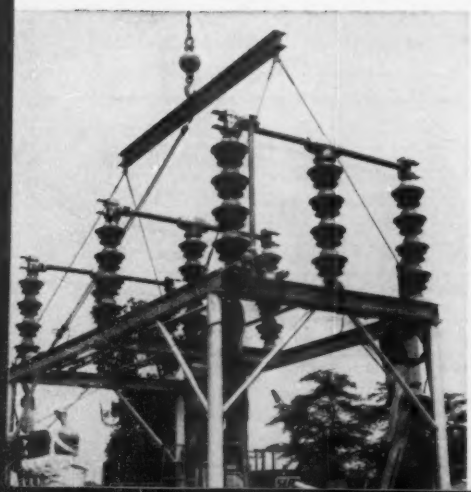
Above is a partial view of the Ravenswood Substation showing some of the switches in place on the aluminum stands. In all, there are 54 disconnect switch structures as well as a variety of structures for bus supports, lightning arresters, coupling capacitors and wave traps, cable potheads, and potential transformers.



Preassembled welded aluminum switch structure as it arrived from the factory. Switch bases are integral with frame. Grounding switches and their interphase rods were also factory installed in many cases.



The photograph at left shows the special sling used to lift the switch package into position on the leg sections. The columns for a typical stand were installed in approximately 10 minutes; insulators were installed in a little over an hour, and the switch lifted and bolted into position in less than 15 minutes.

RAVENSWOOD GOING UP...

A NEW CONCEPT IN SUBSTATION DESIGN AND CONSTRUCTION

Ravenswood transmission substation which serves Con Edison's big new generating plant along the East River in Long Island City, New York, is going up smoothly and quickly. One of the major factors contributing to the speed and ease of its erection is a bold new concept in substation design and construction: factory preassembly of switch structures.

The original idea for these packaged structures came about as a need voiced by Con Edison's engineers. Working with them on the project, Southern States' Structural Engineering Department conceived a practical design permitting much assembly work normally accomplished in the field to be done at the factory.

Ravenswood, the world's largest aluminum transmission substation, was the first practical application for this concept. When construction started, these compact, easily handled units were in the field ready for installation. They consisted of completely assembled welded aluminum frames with integral switch bases, interphase rods, and components of the switch mounted in position. By simply removing the switch live parts and reassembling with insulators, the packaged structures, with switches already adjusted, were ready for installation. In addition, factory fabricated aluminum stands further reduced the number of hours required to get a switch installed.

Some of the advantages of this approach are readily apparent. Contrast the handling required for these factory assembled switch structures to the conventional method of shipping all pole units separately. Further, in usual practice, all interphase rods, clevises, adjustable arms, grounding shunts, and numerous nuts and bolts are unassembled when they arrive at the job site. As construction engineers will confirm, a lot of valuable time is spent sorting and preparing such switches for mounting. And once the switches are in place on their stands, interphase rods have to be installed and the switch completely adjusted for proper opening and closing. (The packaged units require only a minor adjustment of tilting rings after the switch is installed.)

According to Con Edison, savings at Ravenswood are significant.

Although the use of aluminum structures and aluminum stands as employed on this station may not be practical in some areas and for some utilities, the principle involved may represent a real breakthrough in substation construction. For example, the basic idea could be easily applied with factory assembled, bolted steel sections for mounting on any type of stand whether aluminum, steel column, or conventional structure.

With labor costs skyrocketing, serious consideration should be given to the practicability of factory preassembly of switch structures for your next substation.

Why not discuss this new idea with your Southern States representative or contact us direct for additional information?

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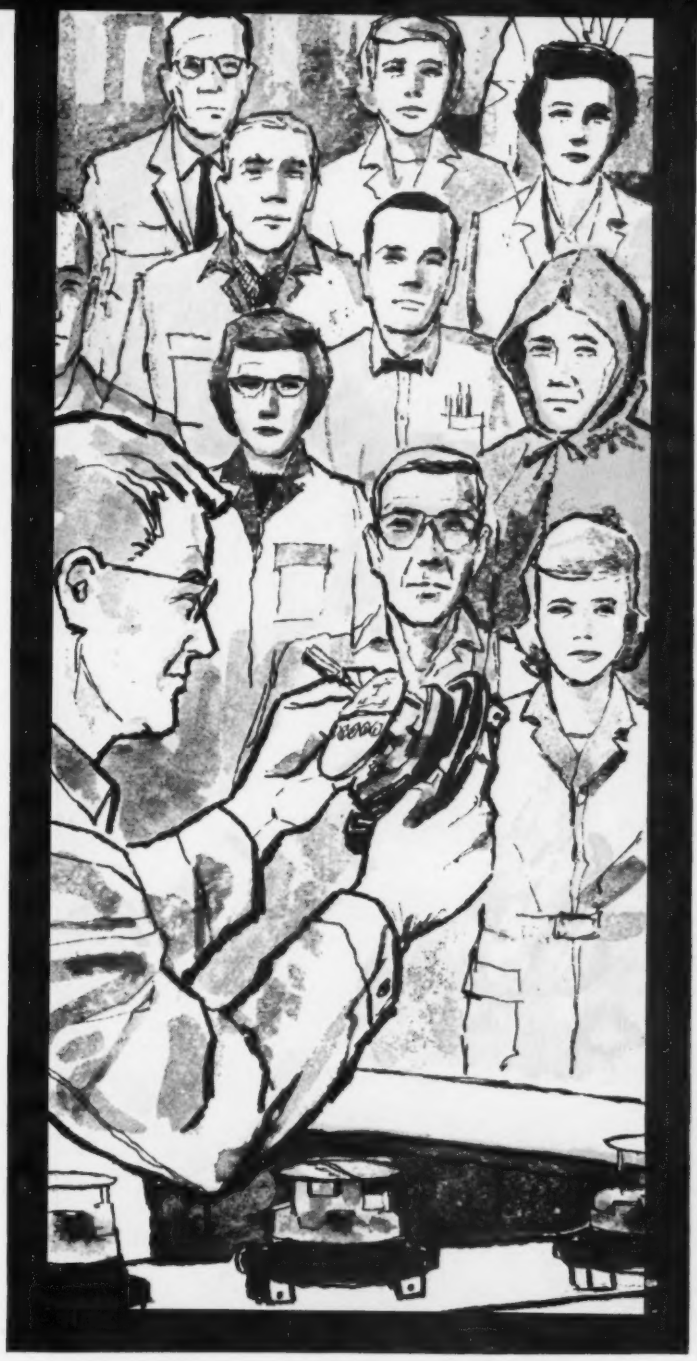

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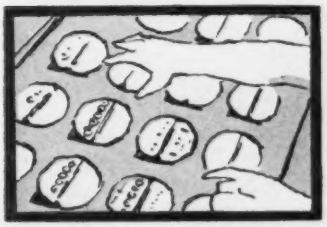

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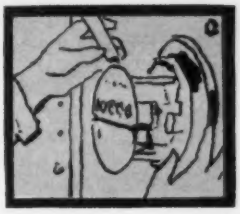

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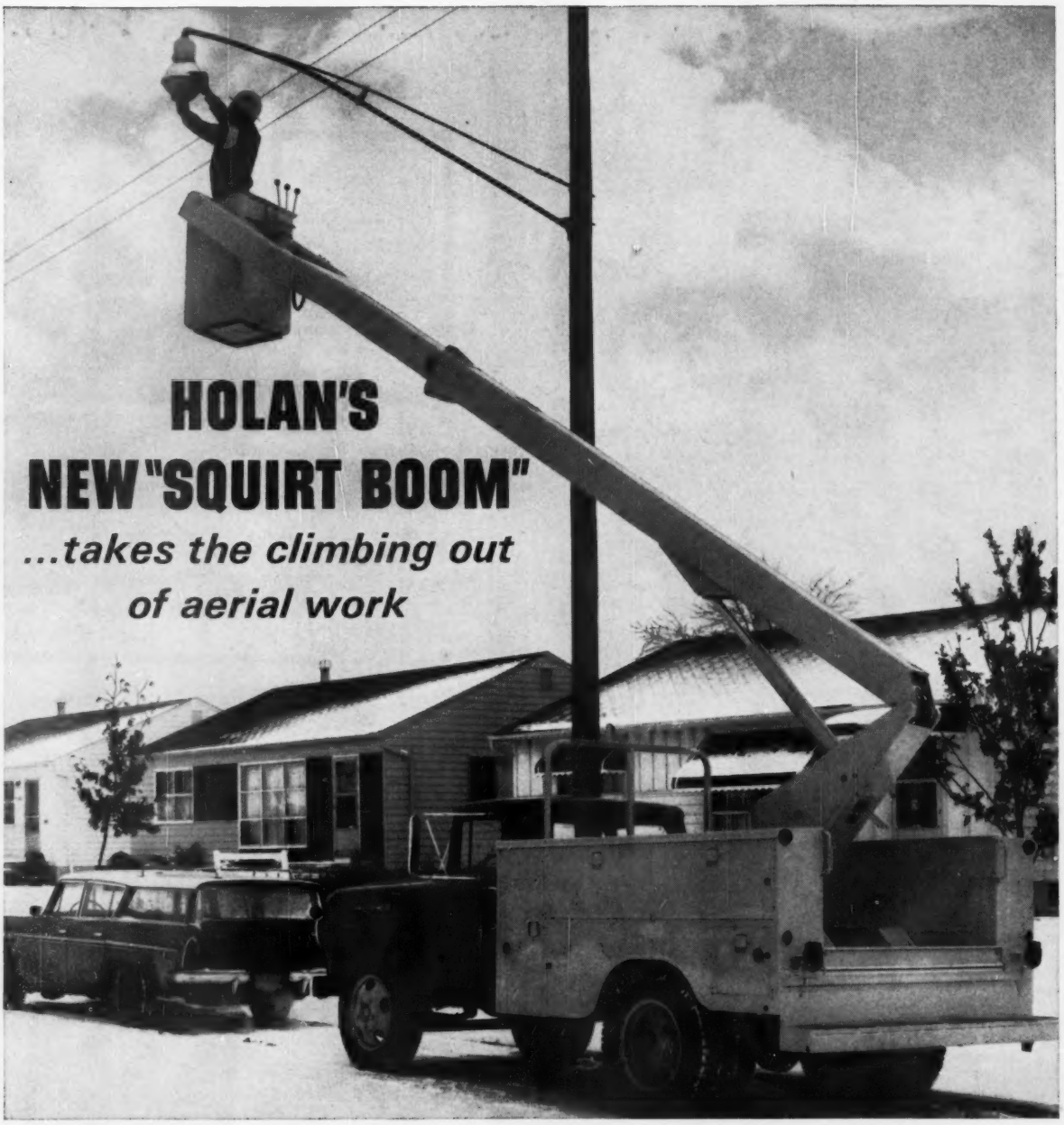

Here it is — Holan's new all-hydraulic Squirt Boom. Ideal for troublemen . . . the fast, safe way to re-fuse transformers. Saves money in group lamp replacement work . . . no climbing up and down a ladder and material and equipment ride in the bucket with the man. Speeds such work as installing electric service, mid-span taps, traffic signal and street light maintenance.

Now one man can do many aerial tasks because he has complete control with levers mounted on the fiberglass bucket (boom and bucket tested at 73,000 volts (A.C.) bucket-to-ground). Telescoping fiberglass boom extends 10′7″. . . raises to a 40-foot working height . . . rotates 360° in either direction. A hydraulic slave cylinder, located in fiberglass bucket yoke, keeps bucket level at all times.

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Let us send you more details on the Holan Squirt Boom . . . designed and built for safe, fast, economical aerial work. Call your Holan Field Representative, or write us.

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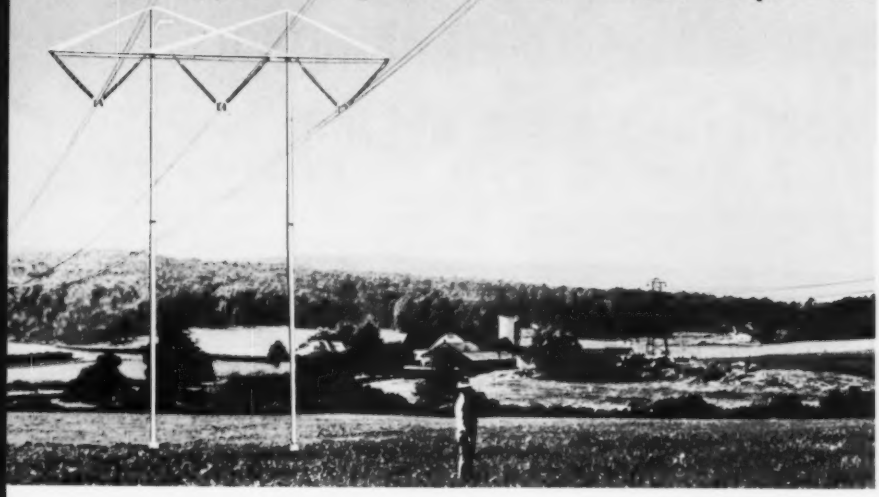
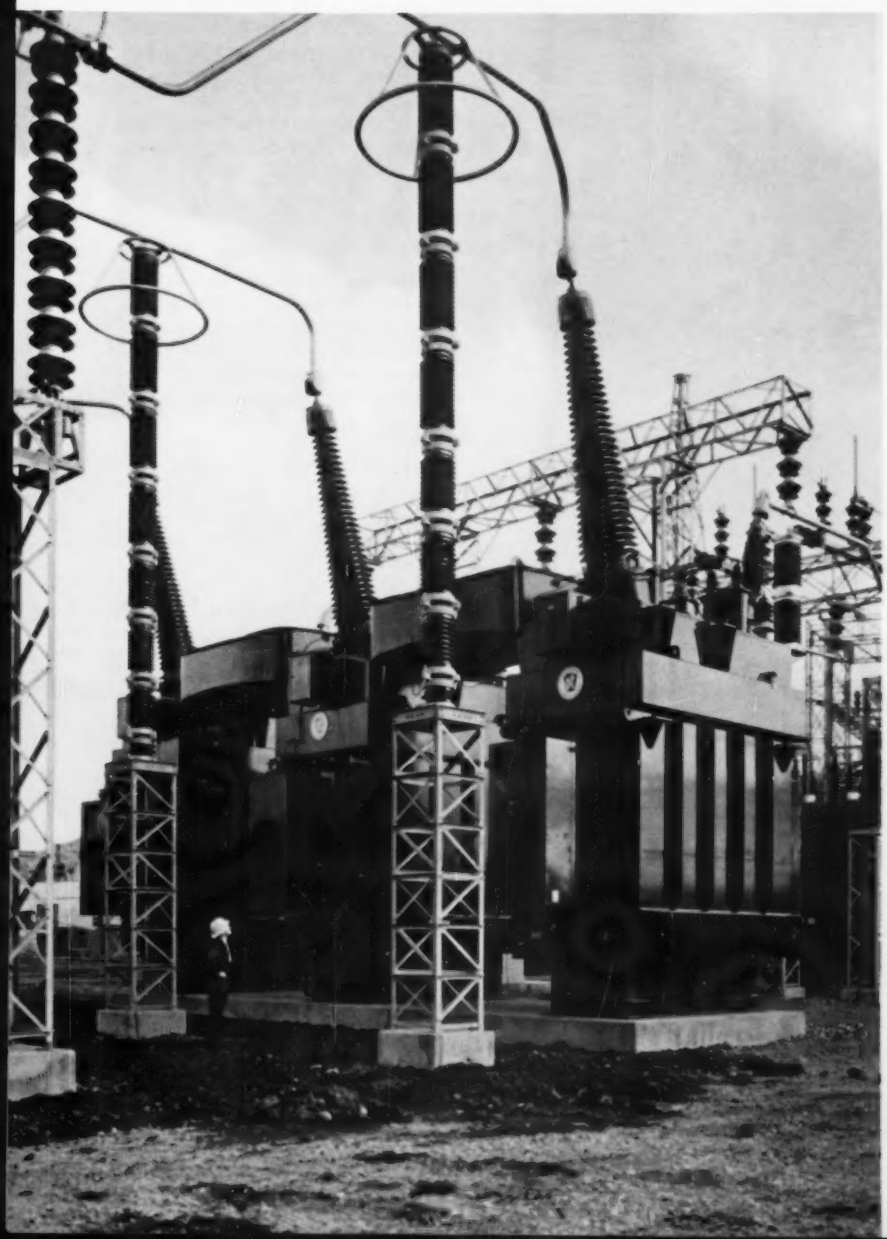




460-kv Pennsylvania transformers now in service on Penelec's EHV line

The 460,000-volt transformers provided by Pennsylvania Transformer Division, McGraw-Edison Company for Pennsylvania Electric Company's pioneering transmission line are the culmination of a million-dollar investment by Pennsylvania in the development of extra-high-voltage transforming equipment. During the next two years, operating data obtained in cooperation with Penelec will help pave the way for eventual EHV "electrical turnpikes" over which large blocks of power can be transmitted economically.

Located at the Saxton end of the 13-mile Penelec line, the bank of Pennsylvania autotransformers is rated 60,000 kva, 460-115 kv. The installation consists of three 20,000-kva single-phase units.

Although now in the realm of the "spectacular," extra-high-voltage installations such as this undoubtedly will play an important part in America's future growth. Pennsylvania Transformer is grateful for the opportunity to help lay a solid groundwork for that future by participating in the Penelec project.

The 460-kv transformers were built with Pennsylvania's basic shell-form insulation system — service-proved in Pennsylvania Contour Design Transformers. For details, write for Catalog P-560.

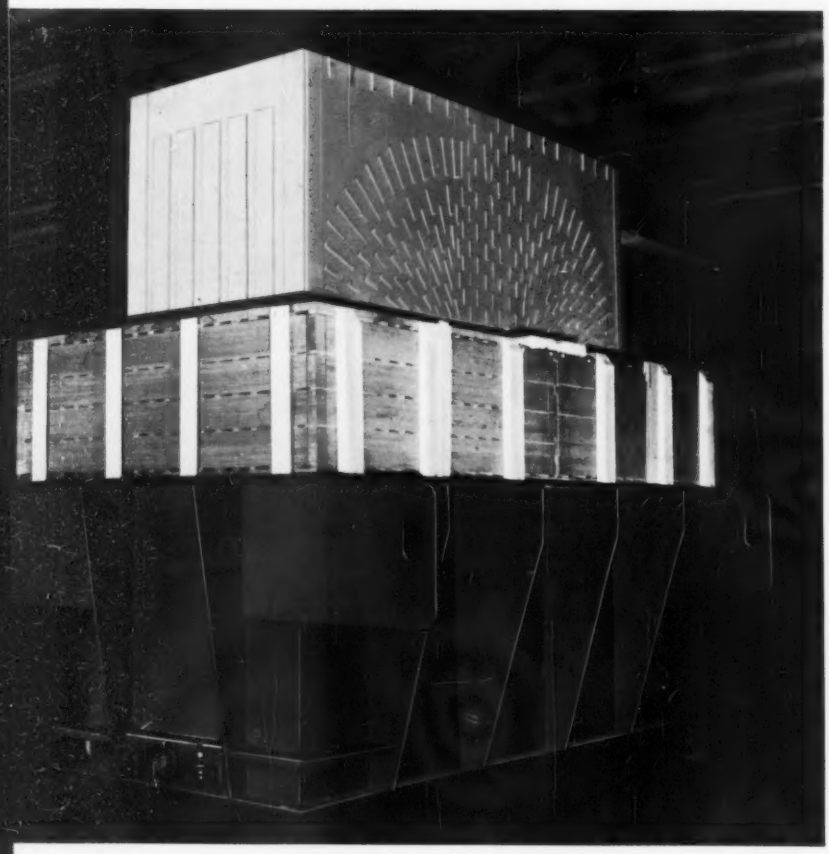
PENNSYLVANIA TRANSFORMER DIVISION

McGRAW-EDISON COMPANY
CANONSBURG, PA.

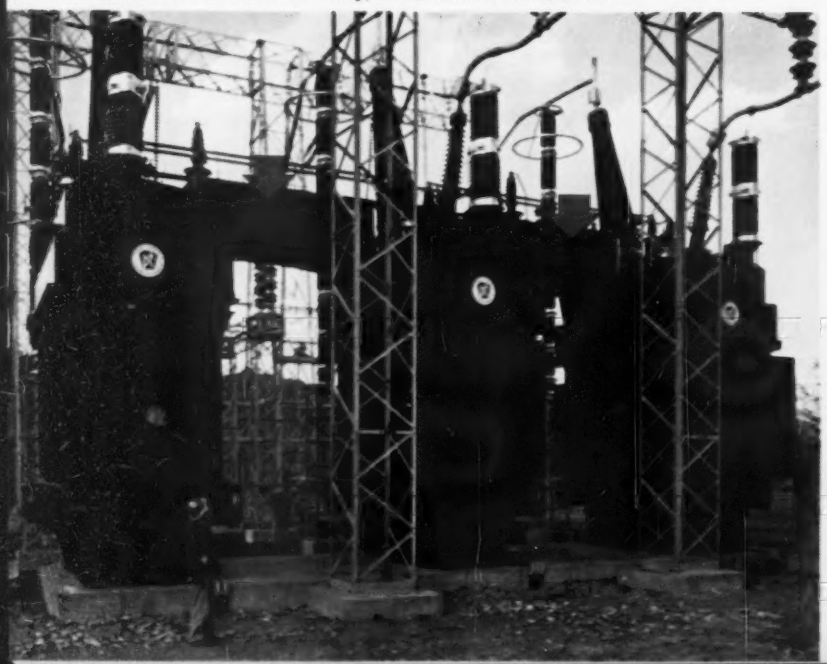
See other side for design details

For Penelec's **EHV** Line . . .

Pennsylvania builds 460-kv transformers with basic shell-form insulation system



460-kv core-and-coil assembly, in bottom section of tank.



In designing transformers for Pennsylvania Electric Company's 460-kv transmission line, Pennsylvania Transformer's engineers met the rigid extra-high-voltage insulation requirements with the same basic insulation system as that used in the company's "lower-voltage" shell-form transformers, which have been manufactured for voltages up to 345 kv. The feasibility of this design for EHV applications has been test-proved in experimental efforts dating back several years. At its plant in Canonsburg, Pennsylvania designed and built an experimental 460-kv unit that served as a prototype for transformers now on the Penelec line. Special testing equipment—including highly sensitive corona-detecting apparatus—provided an accurate guide to refinements in design.

new type of oil-expansion tanks

Among the special design features of Pennsylvania's 460-kv transformers are diaphragm-sealed oil-expansion tanks. Although the expansion tanks themselves are free-breathing, synthetic rubber diaphragms inside the tanks seal the transformer oil from the atmosphere while permitting the oil to expand or contract as temperature rises or falls.

Two internally divided oil-expansion tanks are mounted between the transformers (see arrows), thus utilizing the space resulting from high-voltage bushing phase clearances. This avoided adding to the overall dimensions of the installation.

• • •

Transformers such as the 460-kv units for Penelec's EHV line are possible only because of extensive experience in the design and manufacture of less "spectacular" transformers of widely varying types and sizes. Conversely, data obtained as a result of the Penelec installation will be an important supplement to Pennsylvania's overall research and development program.

PENNSYLVANIA TRANSFORMER DIVISION
McGRAW-EDISON COMPANY
CANONSBURG, PA.

See other side for installation story

Electrical World

SEPTEMBER 25, 1961
Vol. 156, No. 13

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12TH STEAM STATION COST SURVEY is presented in two-color, 16-page report.

The Electrical Week

LATE NEWS ▶ **Broad-gauge study of problems relating to EHV interconnections** by an industry-government committee is proposed by the Interior Department. A spokesman for Interior Secretary Udall tells *Electrical World* that such a study should include feasibility and economics of interconnections as well as voltage standardization. Udall invites representatives from TVA and REA to sit in on government's side (see Dateline, p 3).

Hurricane Esther spares Middle Atlantic Coast utilities, but Long Island Lighting reports one-third of its 600,000 customers out as Esther glances by. New England coastal utilities cross fingers, but don't expect serious damage (see p 36).

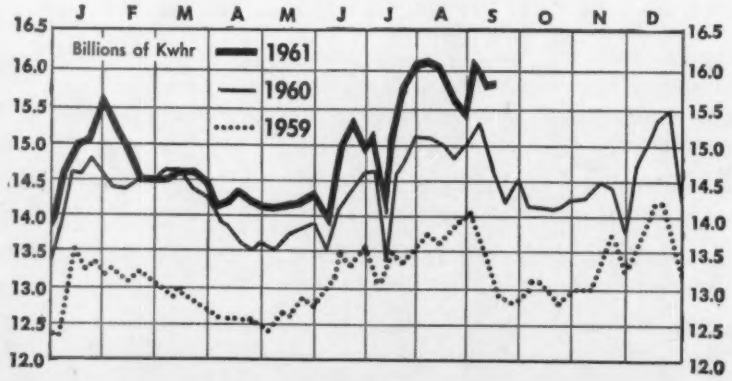
Bonneville Power Administrator Luce tells Columbia Basin Inter-Agency Committee that federal agencies must be prepared to recommend to Congress alternate projects within the US for power and flood control in case Canada does not act soon on Columbia River Treaty. Meanwhile, the one year coordination agreement between Bonneville and non-federal utilities (EW Sept. 18, p 98) is signed by all parties except Seattle City Light and Tacoma City Light. Seattle claims "there are just too many important unanswered questions."

British Columbia Premier W. A. C. Bennett denounces Canadian-US treaty for development of Columbia River as poor deal that Justice Minister Davie Fulton is promoting to boost his personal prestige. In further developments in longstanding fight (EW, Aug. 14, p 64), Fulton hints federal government might withhold necessary license for Peace River project, and British Columbia Power Corp indicates it will sue Bennett's government because of insufficient payment by province for company property.

Legislation to create a four-state Delaware River Compact Commission is approved by both the Senate and the House of Representatives and is sent to White House for President Kennedy's action. As finally voted, the Compact includes five of the six changes recommended by Interior Secretary Udall, but doesn't include the Administration's request to spell out public preference rights at any Compact power projects (EW Sept. 4, p 36).

Move by Los Angeles Department of Water & Power to drop names of smaller suppliers in antitrust damage suits is objected to by General Electric Co. GE claims some suppliers who made no sales to Los Angeles would be kept in suit, and others who made substantial sales would be dropped. Company argues public body is not an individual and thus cannot act capriciously. Federal judge will hear further arguments from the parties involved.

WEEKLY POWER OUTPUT—Up 11.0% (Week ending Sept. 16), Kwhr 15,869,000,000



Per Cent Change From Previous Year

	Sept. 2	Sept. 9	Sept. 16
Total U.S.	+ 5.6	+ 8.4	+11.0
New Eng.	+ 8.9	+11.1	+19.3
Mid. Atlan. ...	+ 9.4	+20.0	+21.3
Cent. Indust. ..	+ 3.1	+ 6.5	+10.0
West Cent.....	+ 4.8	− 0.9	+13.5
Southeast	+ 5.9	+ 8.5	+11.1
South Cent. ...	+ 1.7	+ 4.7	+ 2.5
Rocky Mount...	+ 8.3	+ 4.4	+11.8
Pacific			
NW	+ 2.4	+ 3.1	+ 5.8
SW	+10.2	+ 8.9	+ 6.8

Seasonally Adjusted Index 304

Week Ago 293 Year Ago 274

Source: Edison Electric Institute

Supply Lines

WILL RESIDUAL OIL IMPORT CONTROLS GO BY THE BOARDS?

The loudest campaign yet to quash residual fuel oil import controls is in progress. As in the past, the New England Council is pivotal. Now, however, activities of consumer interests, including the Council, the Oil Users Assn, and the American Public Power Assn, are being tied together by Hill and Knowlton, New York public relations firm. Importers and oil jobbers are putting on the heat, too. In charge of the Washington drive for Hill and Knowlton is Robert K. Gray, Republican White House aide who miffed Eisenhower supporters by publishing an insider's version of the last administration almost before he was off the payroll.

Efforts against the residual controls seem to be snowballing. At first confined to the six New England states and Florida, and their congressmen, opponents now include Hawaii's representatives, and the four senators from New York and New Jersey. They all pitched in recently for a round-robin attack on controls on the Senate floor, and for the first time a solid eastern maritime states group seemed in the making.

The reason for the clatter in Congress is an investigation into the need for residual controls being conducted by the Office of Civil and Defense Mobilization. OCDM has already collected written views of private interests that have a stake in the issue. Now the agency is asking specific questions of these parties, and checking with Defense, State, Interior, Commerce, Labor and Treasury Department officials for their opinions. By mid-October the returns should be in, and a final verdict by President Kennedy could come early in 1962.

At the moment, an end to the controls appears very possible. The domestic coal industry, including producers, railroads and the United Mine Workers, now stands alone in support of continued restrictions on residual imports. As consumer objections to residual controls have become louder, backing for them from the domestic oil industry has become weaker. There is no comparable organized consumer group fighting controls of imports of foreign crude oil, and US oil producers are beginning to fear that the hue and cry against residual controls is hurting their cause for tighter controls on crude and other products.

The issues, as OCDM officials see them, are four. Are controls needed for the health of the US coal and oil industries? To what degree is East Coast industry, dependent on residual, being penalized by the controls? What is their effect on the economy of Venezuela, chief foreign supplier? Does US security require the controls for continuation of the cold war, a prolonged conflict like World War II, a quick, all-out nuclear war, or limited brush-fire engagements?

Boston Edison Co has a dollars-and-cents appraisal of the impact on New England's economy. The utility cites two price increases, totaling 25¢/bbl, in the last 15 months, and says they cost its customers $1.9 million between April 1960 and June 1961.

Anti-residual coal spokesmen say the consumers are figuring the price hikes from an abnormally low period. Dropping controls, the oil companies counter, will bring prices down to those prior levels, because the federal curbs have created an artificial shortage that is naturally inflationary.

With apologies to no one, both sides have entered the debate with conflicting views of the military situation. Coal says shipping would be halted by war, and

the East Coast would have an unhealthy dependence on Venezuelan oil at a time when coal productive capacity was below the point of quick pickup. Consumers say no future conflict in the nuclear age will call for sustained industrial power needed in World War II, and in any case, fixed-target rails are more vulnerable than shipping from the Caribbean. OCDM will settle for the Defense Department's expertise on this point.

Some of the factors pointing toward de-control: the Administration wants to bolster the embattled democratic regime in Venezuela. President Kennedy seems likely to hold out against import quotas for textiles, and it's hard to tell New England that it can't have protection from foreign textile producers, and that it can't buy foreign oil either. With extension of the Reciprocal Trade Agreements Act one of the Administration's legislative musts for next year, this point takes on added importance. Finally, the Administration is trying to help the coal industry through depressed areas aid, purchase of coal for US use abroad, and vigorous activity in the Interior Department's Office of Coal Research. In the face of the pressure from East Coast consumers, continued restrictions on residual may go by the boards.

RAIL RATE REDUCTION KILLS COAL PIPELINE PROPOSAL FOR DETROIT

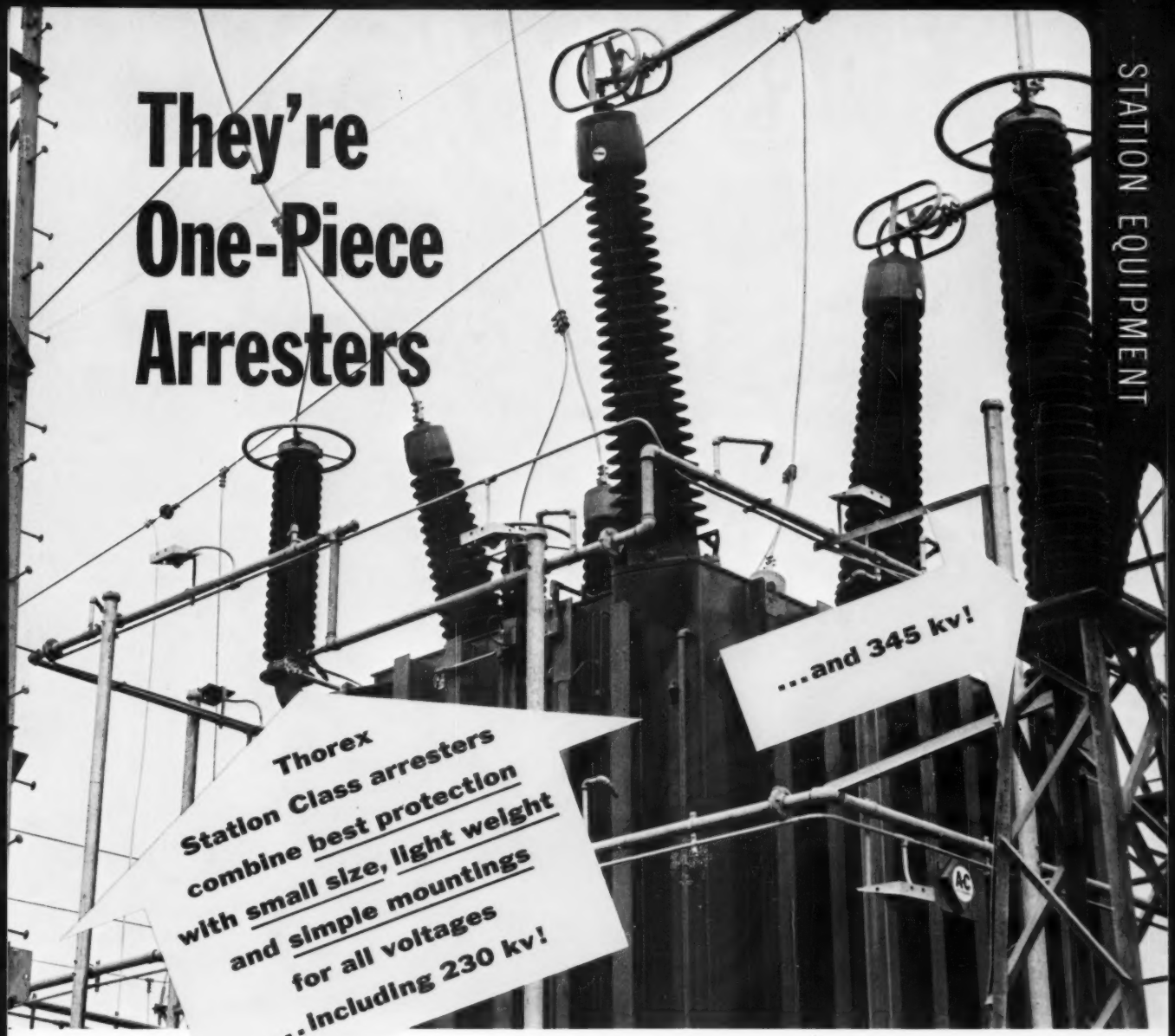
In order to meet coal pipeline competition, a reduction in rail rates for transporting coal to Detroit Edison Co will become effective Oct. 10, unless there are unexpected protests to the Interstate Commerce Commission. The "pipeline-compelled" reductions will be 37.5¢ per ton for the first 6 million tons, and 50¢ per ton for all additional coal on an annual basis. The reductions apply to all coal shipped to all Detroit Edison plants, whether by rail or rail-and-water combination. Present rail rates for Detroit Edison vary from $4 to $5 per ton. Under the new ten-year contract rate, the company expects to use more than 6 million tons in 1962 and about 8 million by 1971.

The coal pipeline, which has been killed now for the next ten years, would have been built if there had been no rate reduction, Detroit Edison says. Assuming that half of the company's coal needs would have come through the pipeline, the average transportation cost reduction would have been about 50¢ per ton. The 14-in, (OD) 253-mile pipeline, originating in Cadiz, Ohio, would have represented a total investment of about $35 million, including $3.5 million for a 2 million ton per year drying plant. Coal cost would have been $4 per ton; pipeline transportation cost, $2 per ton. The pipeline would have carried 4 million tons of coal annually via a slurry composed of 60% coal, 40% water. Texas Eastern Transmission Co and Consolidated Coal Co would have built the pipeline.

WEST COAST GROUP ADOPTS FIRST PAD-MOUNT STANDARD

The Western Underground Committee of the Pacific Coast Electric Assn has adopted a standard for 12-kv pad-mounted transformers. It is believed that this standard is the first to be adopted by a group anywhere in this country for pad mounts. Important features of the standard design include: (1) high-voltage and low-voltage compartments on one end; (2) self-protective design including secondary breakers and high-voltage fuse link; (3) stand-off insulators; and (4) interchangeability of transformers and cabinets.

They're One-Piece Arresters



These one-piece arresters are the smallest and lightest arresters on the market. Only 9½ feet tall and 1050 pounds for the 345 kv arrester and 7 feet, 817 pounds for the 230 kv arrester. Lower voltage models are much smaller, much lighter.

Even the highest voltage arresters are especially simple to mount. Support them on a pipe-mount on the transformer, on a plain pedestal or even hang them within the station structure.

They're single units, complete, ready to operate; so just swing them up in place right from the crate. Two men and a hoist can do it - - in only a few minutes apiece.

Just think - - savings in mountings and installation time can quickly add up to the price of a Thorex Station Class arrester.

Besides this convenience and economy, Thorex also brings you the best protection available. Lowest IR discharge, best thermal durability, dependable service even in high contamination areas comes to you at no extra cost in the Thorex Dynagap Station Class lightning arrester.

For the best performance and the best *installed* arrester price, put Thorex arresters in your new stations.

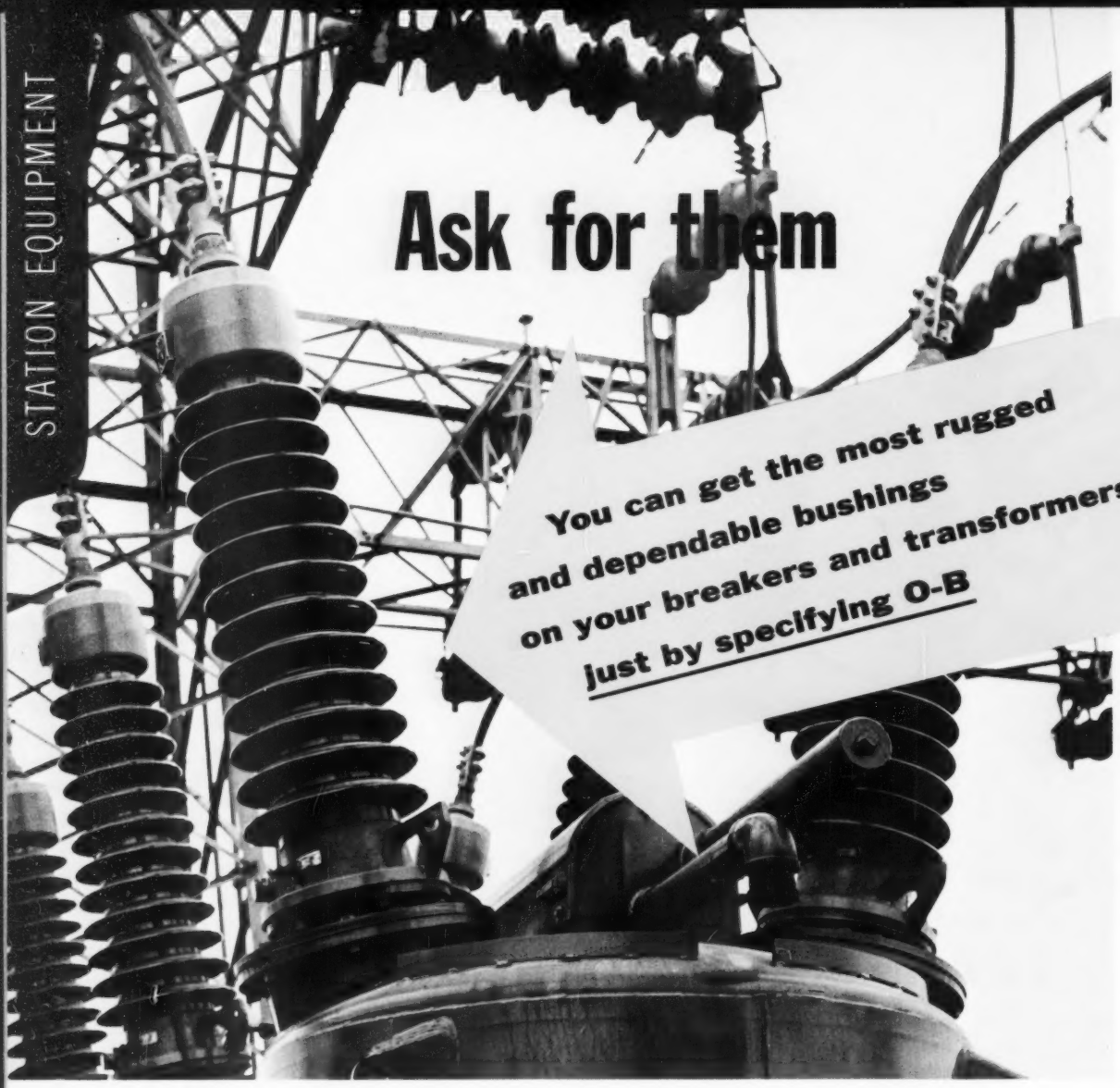
OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass HOLAN

PORCELAIN INSULATORS · LINE HARDWARE · CAPACITORS · LIGHTNING ARRESTERS
BUSHINGS · HOLAN TRUCK MOUNTED POWER DEVICES AND BODIES · BRONZE VALVES

10116-H1

STATION EQUIPMENT


Ask for them
You can get the most rugged and dependable bushings on your breakers and transformers just by specifying O-B

It's a simple matter to get O-B bushings on your circuit breakers and transformers, just ask for them. These rugged and dependable bushings will make your asking for them well worth the effort.

O-B bushings are built to accept shocks beyond the line of duty - - and here's how:

O-B wraps a tight core. Paper and foil laid on the central conductor under high roll pressure act just like an oak log. In fact, after being wrapped, the core is shaped on a lathe just as you would a piece of hard wood. This hard core forms the backbone of O-B's complete bushing assembly.

The protective porcelain-and-metal housing must not leak - - especially when the bushing takes a rap from the interrupter, is jolted in cantilever at the top, or receives rough handling in shipment. Those gasket seals must hold.

O-B's long coil spring assembly and concentric gasketing do it. The coil springs keep constant pressure on the gaskets - - through all temperature changes and as the gaskets grow old. Every shock falls on a sealing system that is capable of complete recovery.

This ruggedness in O-B bushings means you can depend on them. Failure rate for the thousands of O-B condenser bushings in service is nil. That's about as dependable as a bushing can be.

You can get them from 15 kv through 460 kv. Ask your apparatus builder for O-B bushings.

OHIO BRASS COMPANY, MANSFIELD, OHIO

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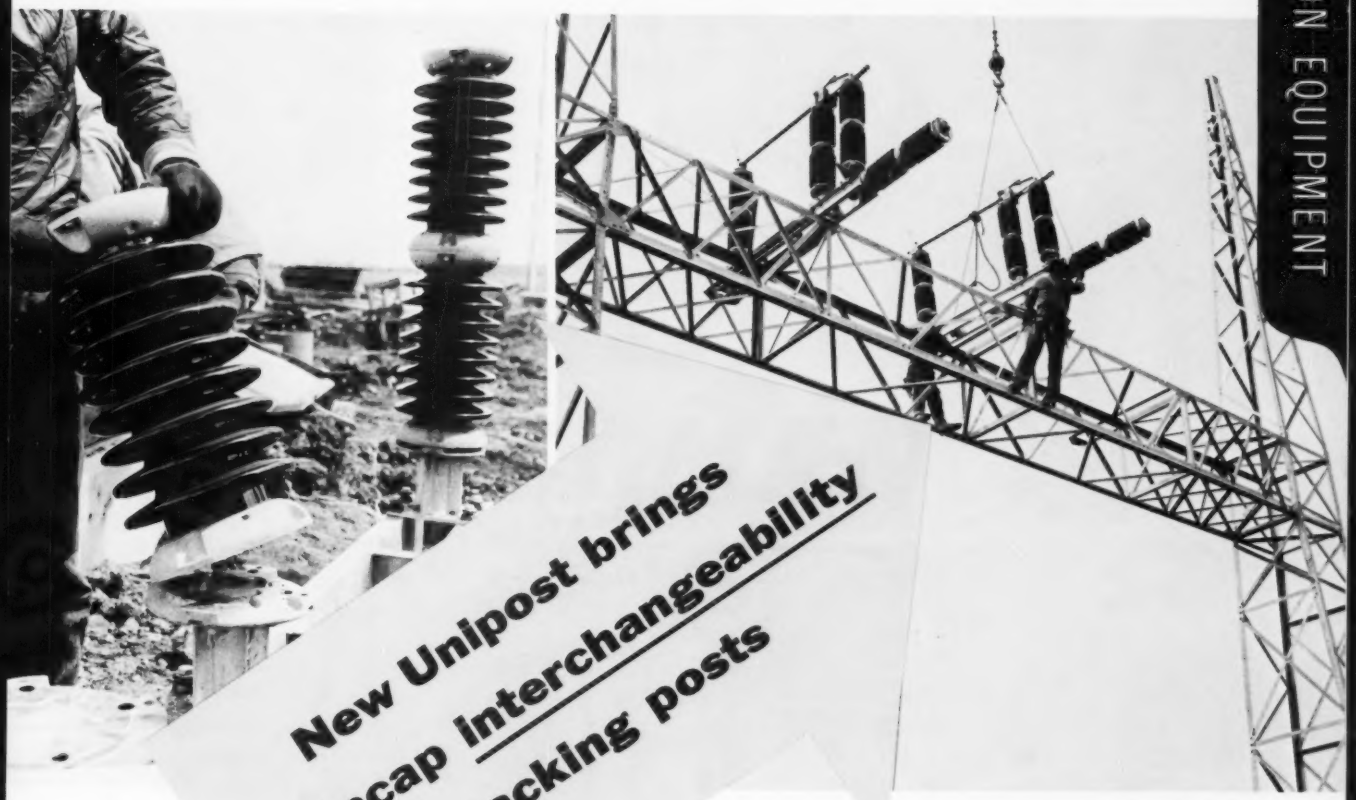
10116-H2

Same insulator, top or bottom

STATION EQUIPMENT



New Unipost brings pincap interchangeability to stacking posts

Assembling a straight stack of pincap insulators has always been a pretty simple job. Only one kind of a unit to handle; bolt them together without regard for order and you've got a pincap stack.

Now, O-B employs this same flexibility of pincaps in stacking posts. The new Unipost fits all positions of the stack - - top, middle, and bottom. Order, inventory and handle only one insulator for each voltage class in the station.

Maintaining the Unipost is a simple job in itself. Carry along just one kind of an insulator to repair a stack. Maintenance crews will never get caught at the site with a top unit when they need a bottom unit or vice versa.

Besides interchangeability, you get the stability of a broad base with Unipost. At higher voltages where the insulator column is taller, stability is particularly important. A little excess deflection in the insulator stack can mean constant trouble in adjustments. Unipost base has three times the area of a conventional insulator base and is used throughout the stack at top, bottom and interunit connections.

And price? A Unipost stack, such as shown here, is competitive with an equivalent pincap stack. Get the interchangeability of pincaps with the advantages of posts in the O-B Unipost.

Ask for them on your next station insulation order.

OHIO BRASS COMPANY, MANSFIELD, OHIO

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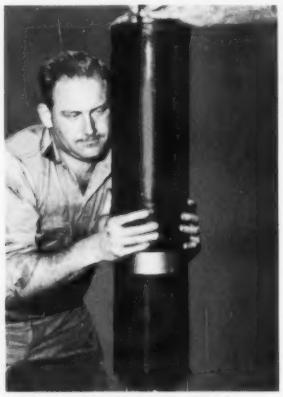
10116-H3

STATION EQUIPMENT

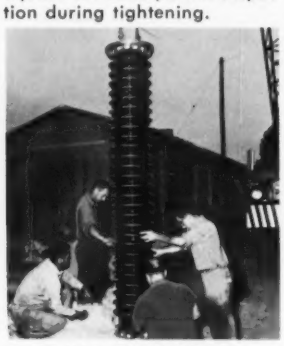
Saves Installation Time

Factory-assembled pothead components speed field work, reduce exposure time

BASE PLATE gets lift into place with all essential fittings in position.



STRESS CONE installation is simply a matter of tightening the build-up on the cable. Square-cut ends permit inspection during tightening.



GRADING CAPACITORS are already installed in this porcelain housing — connected and sealed at the factory.

To save you time and money, O-B pre-assembles under careful factory procedures many components of its capacitor-graded pothead.

Because O-B forms the stress cone right in the lower build-up roll, field installation is simply a matter of tightening the build-up on the cable. Square-cut edges of the roll make inspection during installation easy. The square-cut ends of the roll prove that the stress cone is the same shape as produced on factory machines.

Grading capacitors need never be touched in the field - - they're installed in the porcelain housing at the factory so that when you lower the porcelain into place, the capacitors are ready for service.

If you are planning cable systems and want potheads that are simple to install and are factory-precise, choose O-B.

OHIO BRASS COMPANY, MANSFIELD, OHIO

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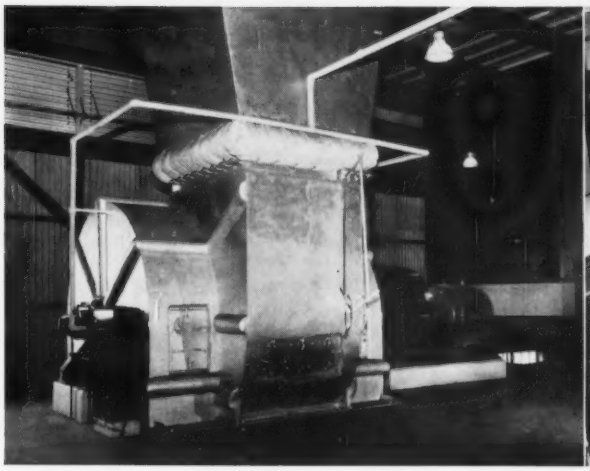
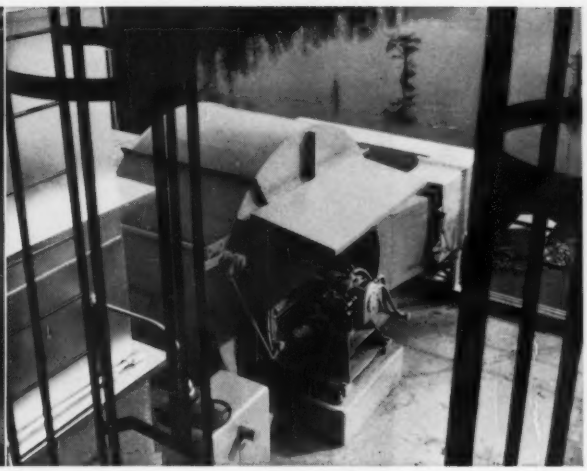
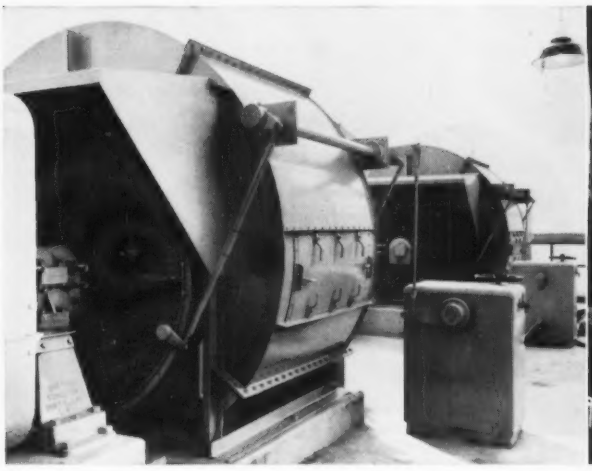
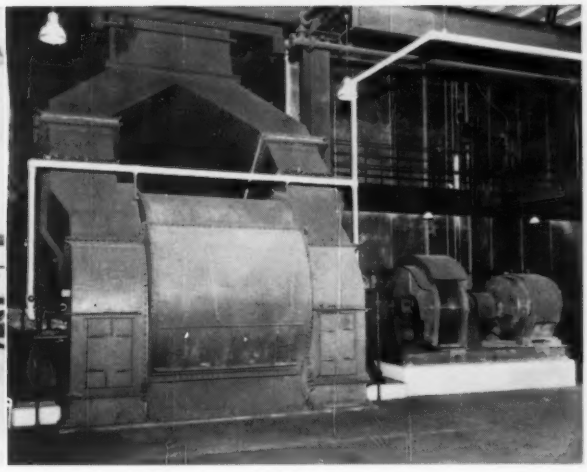
10115-H4





PERFORMANCE...





the practical measurement of fan economy

Like all capital equipment, the true economy of mechanical draft fans can be measured only in terms of performance.

"Lowest" initial cost and "promised" ratings are poor, often *costly* criteria.

'Buffalo' heavy-duty fans are quality-engineered to perform "as specified." Because of this engineering, 'Buffalo' fans use less power . . . require less maintenance . . . deliver extra years of efficient service in the most punishing of mechanical draft uses.

As a result, the economy of 'Buffalo' fans can be accurately measured by actual year-to-year savings in power, maintenance, and replacement costs.

The Buffalo representative in your area is an air handling specialist. It will pay to discuss your requirements with him. Or, you can write direct.

"Buffalo"

AIR HANDLING DIVISION

BUFFALO FORGE COMPANY

Buffalo, New York

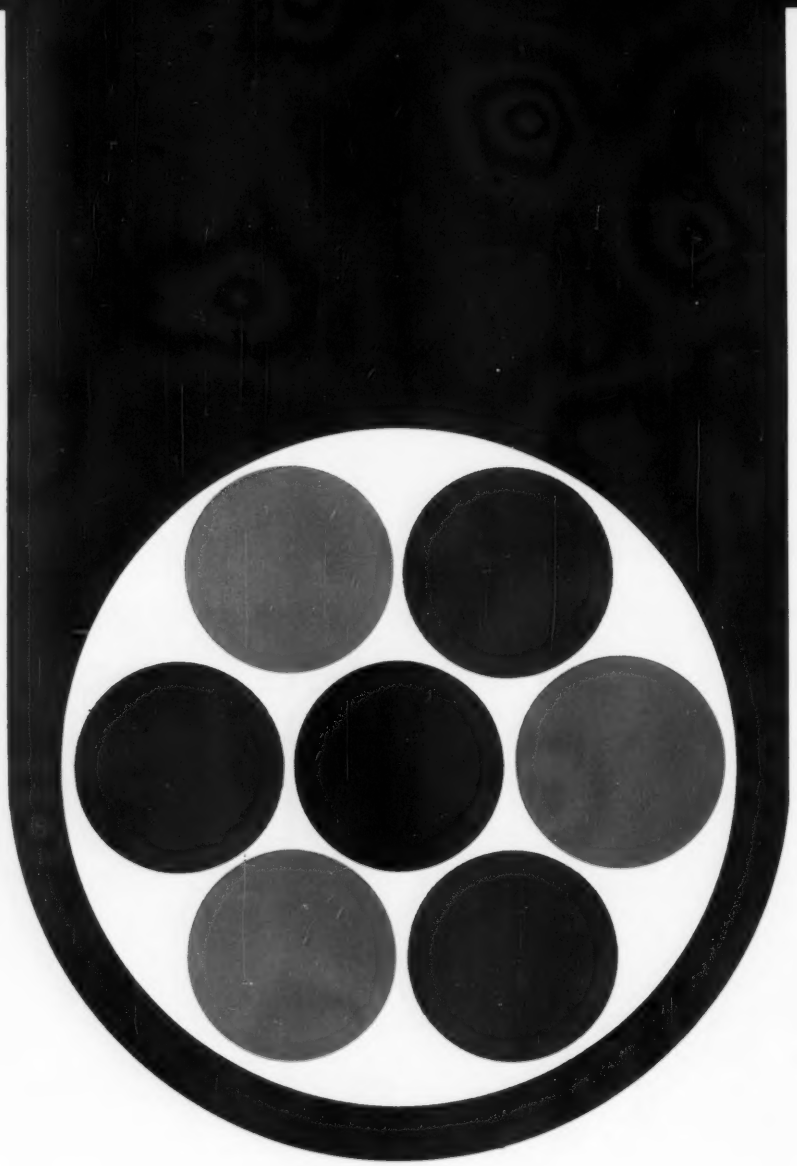
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

'Buffalo' Air Handling Equipment to move, heat, cool, dehumidify and clean air and other gases.

'Buffalo' Machine Tools to drill, punch, shear, bend, slit, notch and cope for production or plant maintenance.

'Buffalo' Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.

Squier Machinery to process sugar cane, coffee and rice. Special processing machinery for chemicals.



NEW WAY TO EVALUATE CABLE!

"VALUE RATINGS" RELATE PERFORMANCE TO IPCEA OR COMPETITIVE STANDARDS

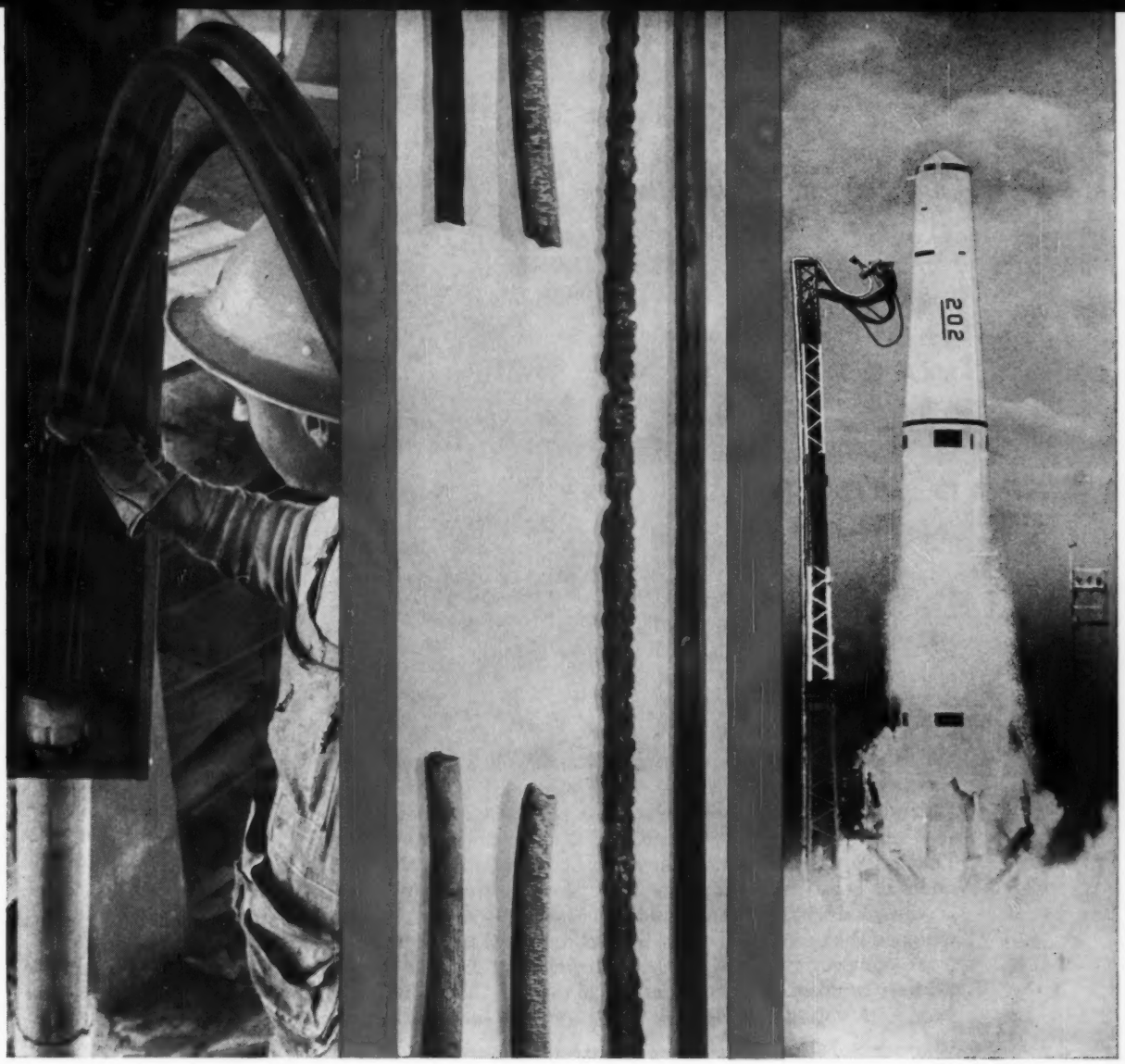
New Value Ratings tell at a glance the composite story of each Kaiser Wire construction—as it performed in as many as 25 specified tests. In each case a well-known standard serves as 100%:

For power cable, the Value Rating standard is all IPCEA test requirements for types of insulation and jacketing specified . . . For portable cord, the standard is service-per-dollar for the least expensive cord (C.V.) as proved by life-expectancy tests. . . . For control cable, the standard is a composite of minimum requirements for eight important insulation qualities.

Compared to these standards, Kaiser Wire constructions earn Value Ratings as large as 767%—valid proof that the spark of quality is Kaiser Wire experience.

For details and Value Rating listings, ask your Kaiser Wire Distributor for free K/W Value Rating Bulletins, or write: Kaiser Wire, Room 844a, Kaiser Aluminum & Chemical Sales, Inc., Kaiser Center, 300 Lakeside Drive, Oakland 12, California.

KAISER ALUMINUM & CHEMICAL CORPORATION



KAISER GRIZZLY® POWER CABLES PACK RUGGED "DOUBLE PROTECTION"

The insulation and jacketing of K/W Grizzly Spec. 831 power cables deliver more than double the protection required by IPCEA specifications. In ozone resistance, K/W Kalzone® insulation (special butyl compound used in K/W Grizzly cables) exceeds the IPCEA 3-hour minimum by *more than 70 hours*. Typical test values after aging of special K/W Neoprene 10-S jacketing exceed IPCEA minimums by wide margins. Overall comparison against IPCEA tests: 270%—the Value Rating of K/W Cable Spec. 831.

K/W GRIZZLY POWER CABLE SPEC. 831
VALUE 270% RATING

KAISER NEOPRENE 10-S CABLE JACKET RESISTS OZONE LONGEST

The picture above shows competing neoprene jackets that were stretched to twice their original lengths and exposed to .025–.030% ozone. Time: 2 hrs., 23 min. from start. Two have failed. Seven minutes later, the third competitive sample (second from right) failed. The jacket at right—special Neoprene 10-S used on K/W Grizzly power cables—was intact *18 hours later!* Kalzone® insulation of K/W Grizzly cables stood 72 hrs. in similar tests. IPCEA butyl insulation requirement is 3 hours.

K/W GRIZZLY POWER CABLE SPEC. 831
VALUE 270% RATING

KAISER LAYTEX® CONTROL CABLE SENDS "THOR" TOWARD ITS TARGET

A single K/W Laytex control cable of 84 conductors gives Air Force "Thor" its final sendoff. Kaiser Wire has designed more than 650 such cables for missile ground controls, offering distinct advantages: Patented K/W Laytex gives greater insulation protection than any other rubber, and resists heat better than plastics. The patented Laytex-Resin construction delivers final cable diameters that are among the world's smallest. The choice of K/W insulations is the industry's widest.

K/W LAYTEX-RESIN CONTROL CABLE
VALUE 767% RATING

IN COPPER AND ALUMINUM CABLES...THE SPARK OF QUALITY IS KAISER WIRE EXPERIENCE! KAISER ALUMINUM

In Industrial and Commercial Installations...

WAGNER®

SUB URBAN

PAD MOUNTED TRANSFORMERS

conserve space and eliminate costly, ugly enclosures

When you plan a new distribution substation, or rework or modernize an existing system, write Wagner® Sub-Urban pad mounted transformers into your standards. They are contained in compact, tamper-proof housings that make costly, ugly, fenced enclosures unnecessary. Save space, too. They're so well ventilated they can be installed up close to the building and still be loaded to capacity. Some low shrubbery will hide them neatly ... the good looks of your buildings and landscaping are retained. People who use the buildings served by pad mounted transformers are protected from exposed hot-lines, and your crews are protected by a door over the primary compartment which lets them work on the secondary without danger from high voltage. Enclosures lock tightly to protect the equipment itself.

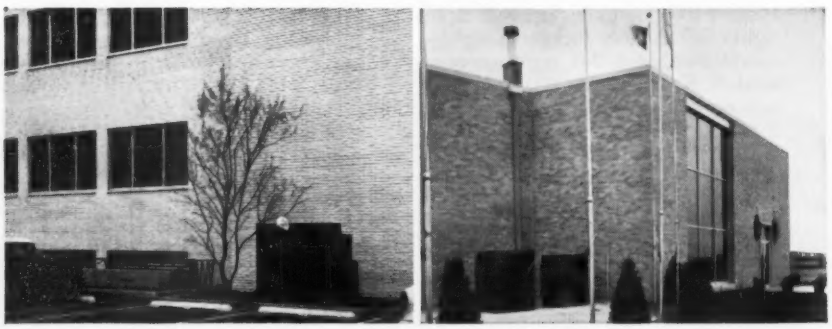
Wagner Sub-Urban pad mounted transformers are available in single-phase, 25-167 kva; three-phase, 75-750 kva. They require only routine maintenance, and when load growth makes it necessary, larger transformers can be quickly and easily installed to replace original units.

Check with your Wagner Sales Engineer. He's got complete data on Sub-Urban pad mounted transformers..all the facts and figures that prove how easy it is to plan less costly, space-saving transformer installations.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner Electric Corporation

6456 PLYMOUTH AVENUE, ST. LOUIS 33, MISSOURI

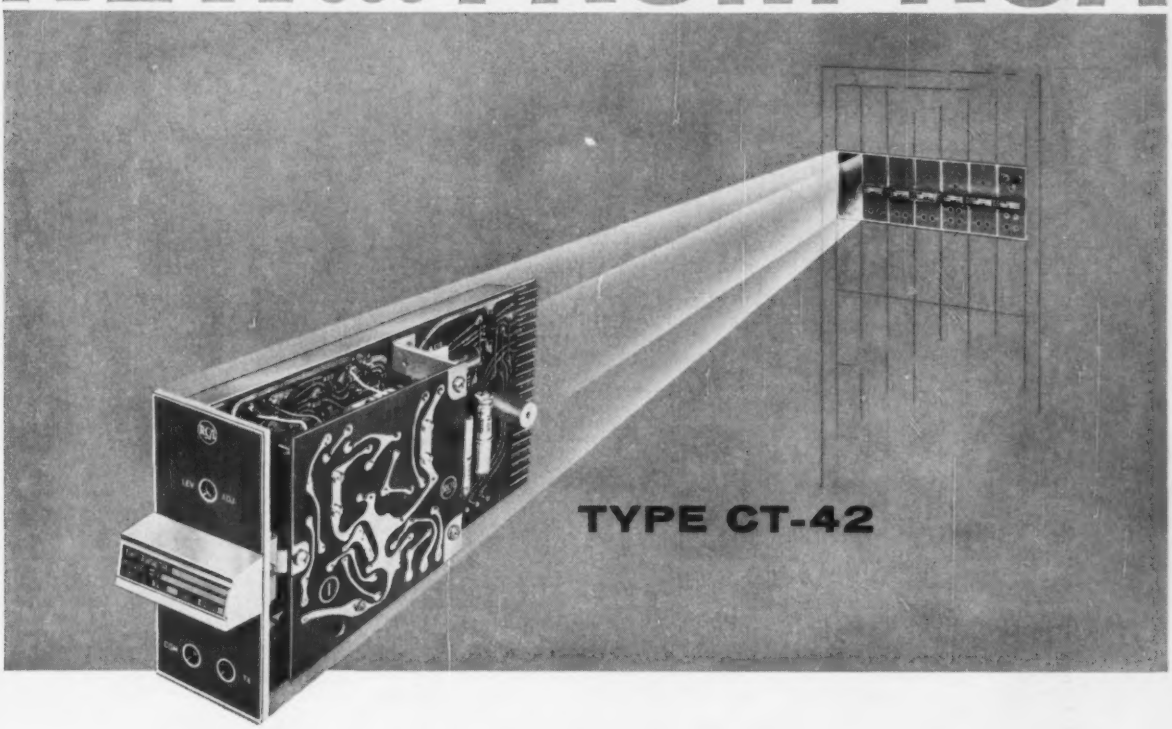


This Wagner Sub-Urban transformer is installed at the Park Ridge, Illinois, executive offices of the Square D Company. It is a 500 kva, three-phase delta-connected, 4160 volt primary transformer.

These transformers serve the Dorcherster Club in Dolton, Illinois. The larger transformer supplies power to refrigerate an indoor skating rink. The smaller unit powers the club's general services and all-electric kitchen.

WT61-3

NEW... FROM RCA



SOLID STATE TONE MULTIPLEX

FOR WIRELINE, MICROWAVE OR CARRIER

24 channels from 420 to 3180 cps—Spaced every 120 cycles (CCITT Standards)
18 channels from 4300 to 7600 cps—Spaced 170 to 220 cycles

The CT-42 is an all new tone multiplex of high performance designed to operate over a wide environmental range. Ruggedly built, it uses computer grade components for lasting dependability.

Each channel can be frequency-shift or AM keyed for teletype, telemetering, control or data signals. Six transmitters or receivers in any combination may be plugged into a standard shelf which also contains a husky regulated power supply.

Channel units operate from 24 V DC or 117 V AC power supply.

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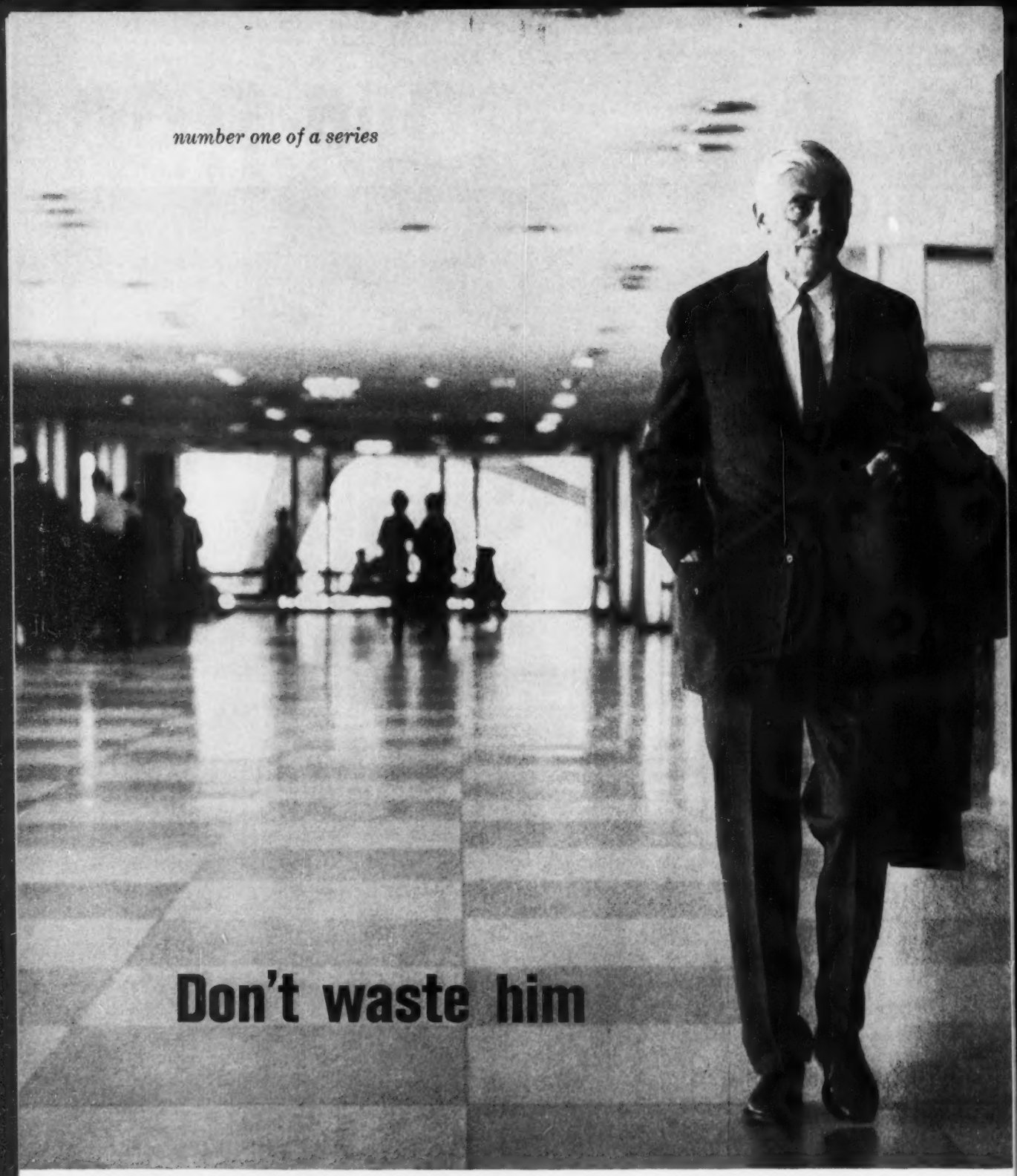

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But the cards are stacked against him.

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The men with responsibility for equipment purchase are looking for facts. Their jobs depend on them. You help them when your ads spell out the details on your company and its products. And you help your salesman,

**based on averages for salary and expenses estimated by American Salesman Magazine*

who can then concentrate on proposals and personalities —the difficult selling jobs that *only* he can handle.

Check your sales reports for the jobs that slow your men down. Then plan specific ads to do those jobs for you through Electrical World, first choice of the men who buy, according to 17 manufacturers' own surveys.

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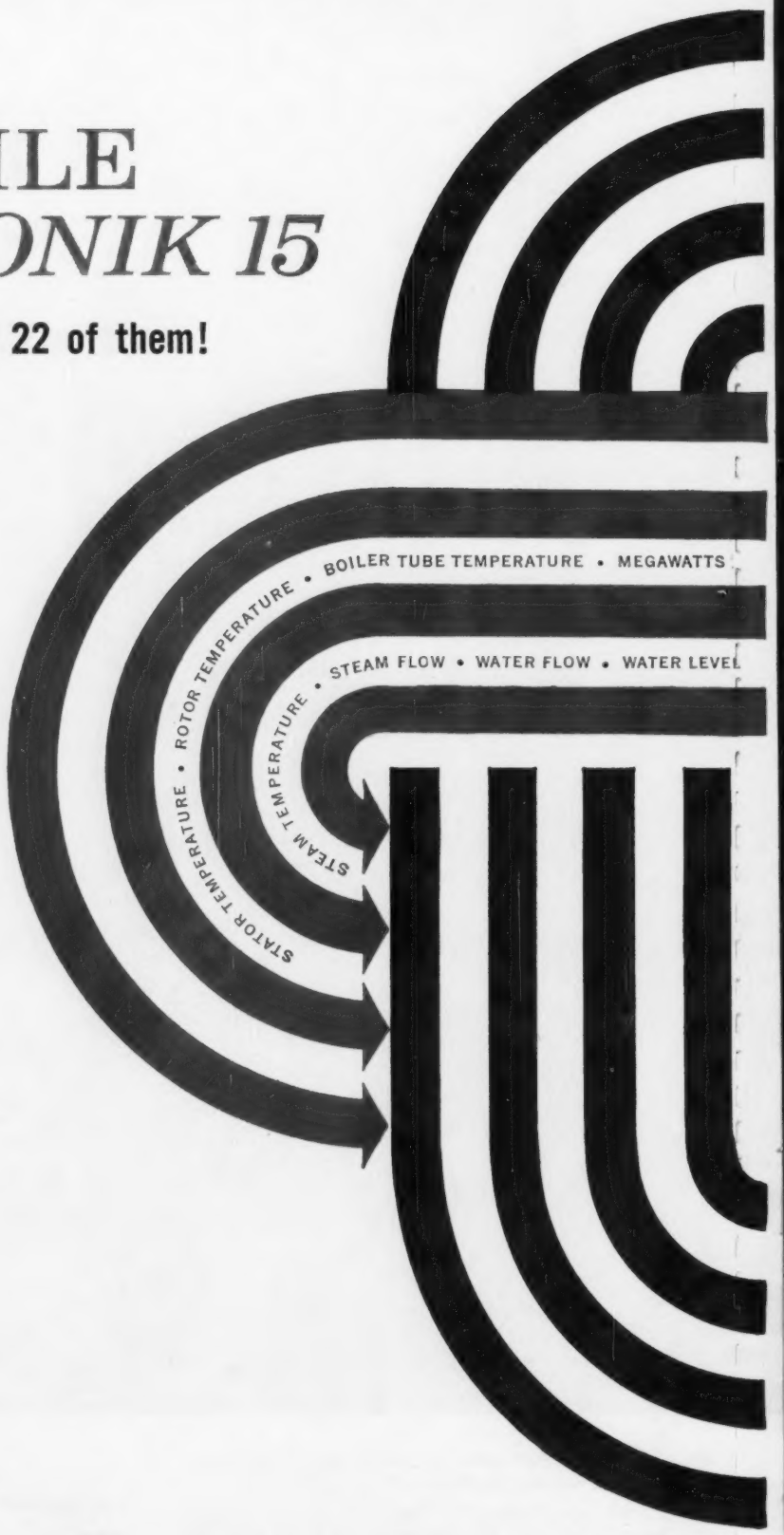
VERSATILE *ELECTRONIK 15*

records and indicates all 22 of them!


BOILER TUBE TEMPERATURE • MEGAWATTS
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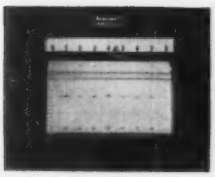

Generating Stations and Dispatch Centers depend on Honeywell *ElectroniK 15* instruments to keep a close check on more than 22 variables . . . from watts, vars, steam flow, stator temperatures . . . to system frequency, tie line interchange, and time deviation.

ElectroniK 15 gives a choice of many measuring circuits, types of records or indication, pen or print wheel speeds . . . lets you incorporate a wide variety of functions or devices. The newly designed modules in the *ElectroniK 15* line have operating and servicing features that represent the very latest developments in the art of reliable instrumentation. Its 11-inch calibrated chart width provides easier, more accurate reading. 112 Honeywell service and sales offices throughout the country are dedicated to the job of keeping *ElectroniK 15* instruments in top operating condition.

With *ElectroniK 15* on the scene, it is no longer necessary to be strapped to a single line of instruments. Many leading utilities throughout the country already know about *ElectroniK 15's* performance and dependability. You can get the facts on the *ElectroniK 15*, too, by contacting your nearby Honeywell field engineer. MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa. In Canada, Honeywell Controls, Ltd., Toronto 17, Ontario.

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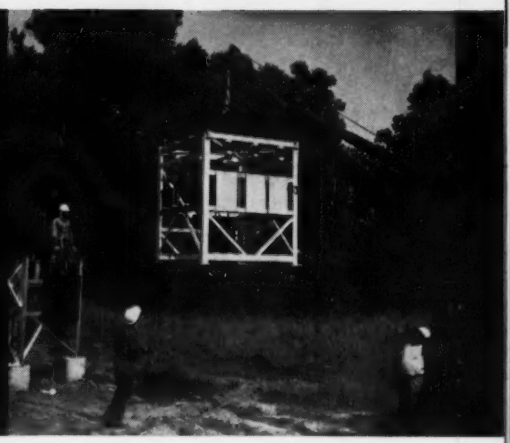
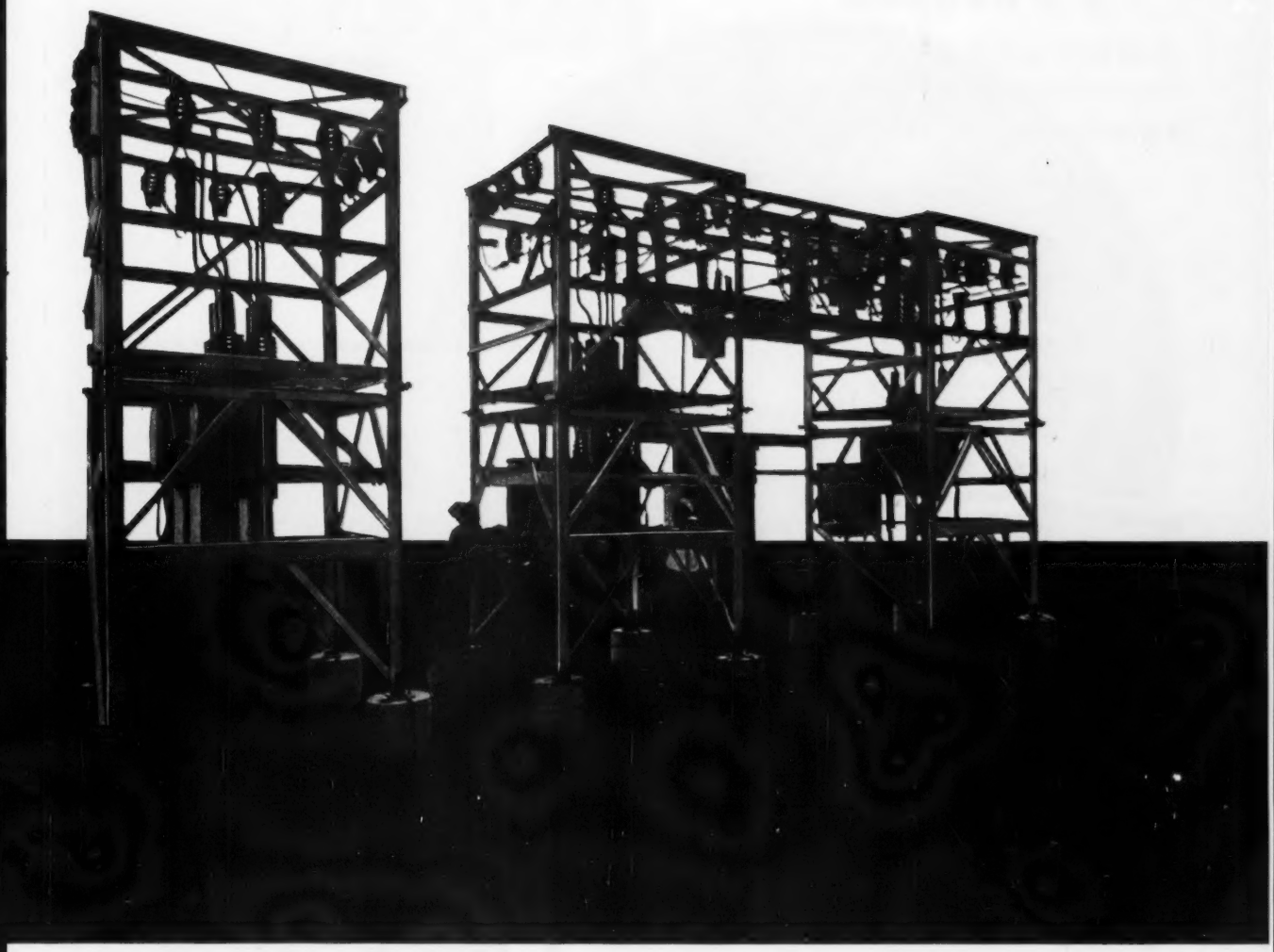
HONEYWELL INTERNATIONAL Sales and Service offices in principal cities of the world. Manufacturing in United States, United Kingdom, Canada, Netherlands, Germany, France, Japan.

"We saved in equipment cost and erection time with these new PR Recloser Feeder Structures"

Mr. Chester L. Williams, District Engineer, Union Electric Company, St. Charles, Missouri



Westinghouse PR Recloser Feeder Structure being installed in Mark Twain Substation of Union Electric Company.



New Westinghouse PR Recloser Feeder Structures are shipped in two sections as a complete package for the low voltage side of a 15 kv distribution substation. The cost is about 25% less than conventional methods of using other types of equipment, fabricating steel structures, assembling and wiring associated equipment and bus work. Installation requirements have been so simplified that Union Electric used a three-man crew for the job shown above. After bolting the four legs of the lower section to prepoured concrete supports, they hoisted the upper section of each recloser into place and bolted the two sections together. Elapsed time —about an hour for each recloser structure.

Each section is factory assembled and wired. You need only bolt them together then connect the transformer leads and incoming feeder leads. Each unit has dead end supports for feeder conductor, a PR recloser, lightning arresters and feeder metering equipment.

Periodic maintenance operations are simplified with the draw-out construction of the PR feeder structure. A simple tank lifter operation then lowers the recloser and disconnects the draw-out contacts—the recloser is visibly safe for maintenance.

Get more information. Call your Westinghouse Sales Engineer or write for Descriptive Bulletin 38-730. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

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J-65003

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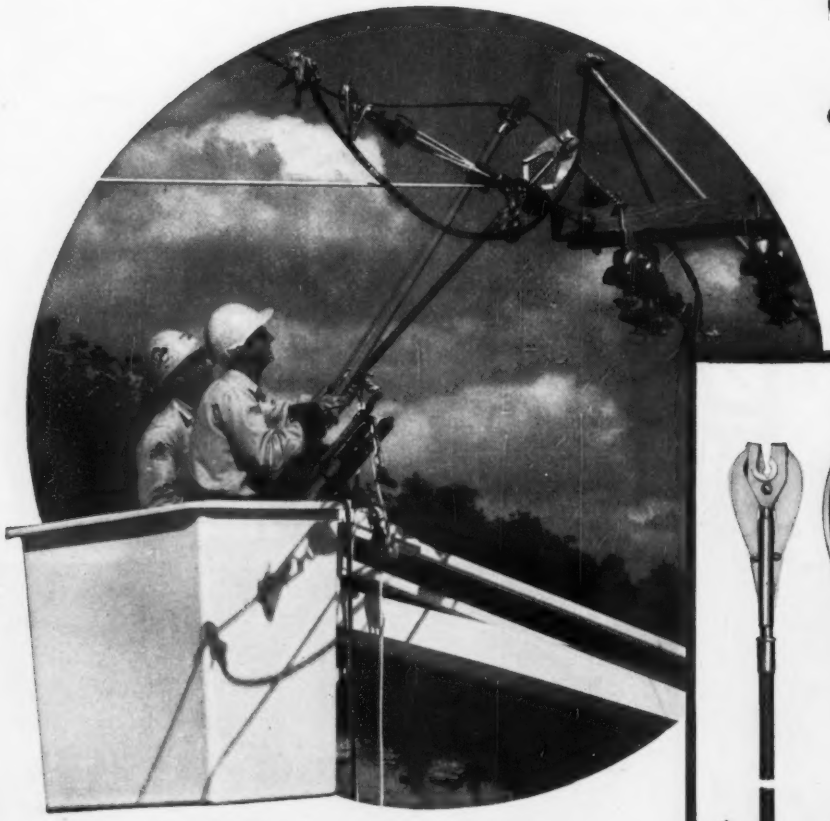


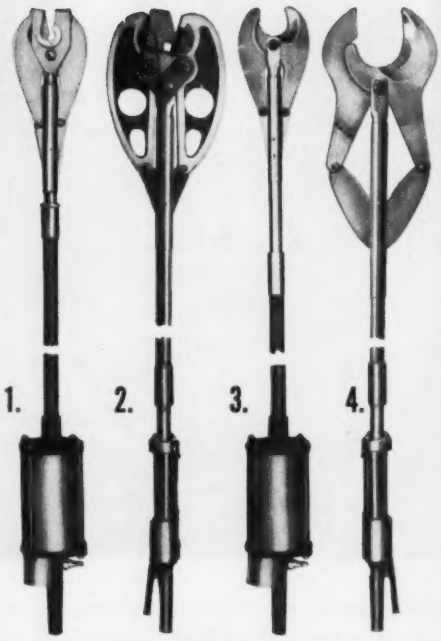
Mechanization in maintenance saves time and effort!

"Mechanize" your overhead line construction and maintenance work by using Chance Power Tools from your aerial insulated platforms or buckets. You save time and effort — realize a greater return on your investment in power lifts — and you cut costs by making maximum utilization of highly skilled line crews.

Linemen like the way these tools complete their task with just a press of the thumb on the trigger. For example, compare the few seconds it takes the multi-cable cutter to slice through a 3" lead-sheathed cable with the time and effort required to do the job with a hack saw!

The initial cost of Chance Power Tools is quickly paid by the savings you gain through increased productivity.

Ask your Chance man for more Power Tool information, or write for Bulletin 635.



1. Air-powered ACSR cutter. Cuts single steel cove ACSR conductor up to 477 MCM (18/1).
2. Hydraulic-powered guy strand cutter. Neatly severs steel guy strand through ½" diameter.
3. Air-powered power-cable cutter. Cuts through copper stranded cable up to 1000 MCM or insulated cable to 2" O.D.
4. Hydraulic-powered multi-cable cutter. Has capacity for insulated or lead-sheathed cable up to 3" in diameter.

Operate from Air or Hydraulic Power

All the cutters shown above, plus hook-over and shear-type pruners, tree saws and brush cutters are available in two complete lines. Air-powered tools are operated from an air compressor or bottle of dry nitrogen or CO_2. Hydraulic-powered tools can be operated from the standard hydraulic source of the insulated bucket or truck "A" frame.

A. B. CHANCE CO.
CENTRALIA, MISSOURI
A. B. Chance Co. of Canada, Ltd., Toronto CT61-31

make your own scale model "SMRT"

New ALLIS-CHALMERS SURFACE-MOUNTED RESIDENTIAL TRANSFORMER

fully compartmentalized for safety!

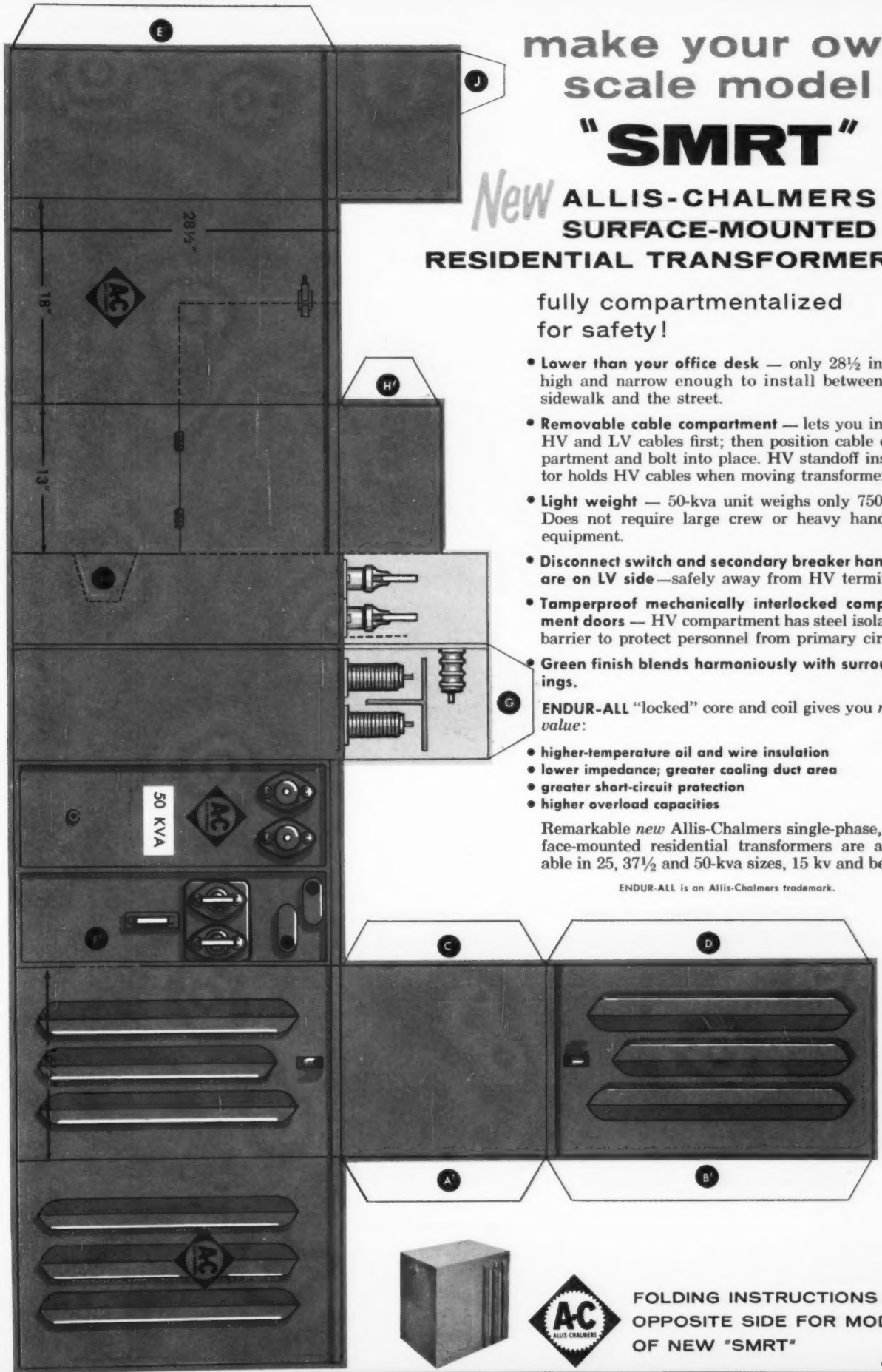
- **Lower than your office desk** — only 28½ inches high and narrow enough to install between the sidewalk and the street.
- **Removable cable compartment** — lets you install HV and LV cables first; then position cable compartment and bolt into place. HV standoff insulator holds HV cables when moving transformer.
- **Light weight** — 50-kva unit weighs only 750 lbs. Does not require large crew or heavy handling equipment.
- **Disconnect switch and secondary breaker handles are on LV side**—safely away from HV terminals.
- **Tamperproof mechanically interlocked compartment doors** — HV compartment has steel isolation barrier to protect personnel from primary circuit.
- **Green finish blends harmoniously with surroundings.**

ENDUR-ALL "locked" core and coil gives you *more value*:

- **higher-temperature oil and wire insulation**
- **lower impedance; greater cooling duct area**
- **greater short-circuit protection**
- **higher overload capacities**

Remarkable *new* Allis-Chalmers single-phase, surface-mounted residential transformers are available in 25, 37½ and 50-kva sizes, 15 kv and below.

ENDUR-ALL is an Allis-Chalmers trademark.

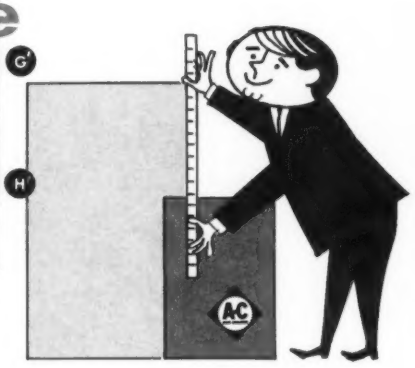


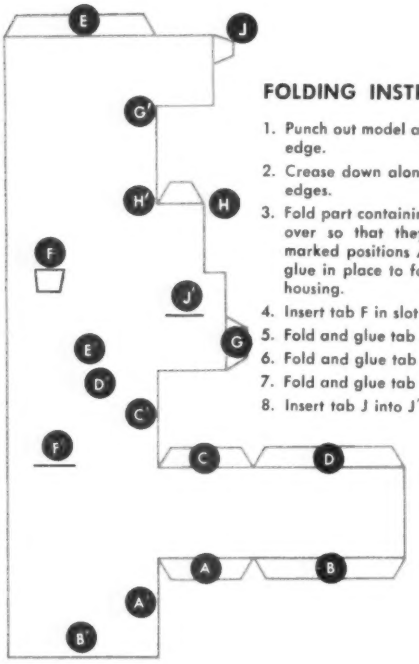
FOLDING INSTRUCTIONS ON OPPOSITE SIDE FOR MODEL OF NEW "SMRT"

A-1528

COMPARE **SUPER-COMPACT ALLIS-CHALMERS SURFACE-MOUNTED RESIDENTIAL TRANSFORMERS WITH ALL OTHERS!**

"SMRT" is less than ¼ the size of the average of six other makes





FOLDING INSTRUCTIONS

1. Punch out model along perforated edge.
2. Crease down along all scored edges.
3. Fold part containing tabs A B C D over so that they are opposite marked positions A′ B′ C′ D′ and glue in place to form transformer housing.
4. Insert tab F in slot F′.
5. Fold and glue tab G to G′.
6. Fold and glue tab E to E′.
7. Fold and glue tab H to H′.
8. Insert tab J into J′.

Check the chart below! It introduces you to new dimensions in surface-mounted residential transformers. Example: the A-C 50-kva "SMRT" is just 28½ inches high, 29 inches deep and 18 inches wide! That's just 15,660 cubic inches of cabinet compared to competitive cabinets as large as 83,927 cubic inches. Smaller size means easier shipping and handling. Foundation, labor and equipment costs are lower.

Dimensions of A-C 50-kva Surface-Mounted Residential Transformers "SMRT" compared with six other makes

Make	A-C	Brand A	Brand B	Brand C	Brand D	Brand E	Brand F
Height	28½	41	46	43	38¼	38½	42
Depth	29	34	44½	48½	40	45	49
Width	18	36	41	40	37	40	36
Cubage	15,660	50,184	83,927	83,420	56,610	69,300	74,088
% larger than A-C	—	220%	440%	430%	260%	340%	370%

Weights of competitive units are correspondingly greater.

Write, wire or phone your nearby A-C office for more surface-mounted residential transformer facts or copies of Ad A-1528. Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

ALLIS-CHALMERS

Pacing Power Progress

Editorial Comment

SEPTEMBER 25, 1961

The Hanford Victory—No Time for Shouting

The Kennedy Administration's proposal to install 800 kw of power generating capacity at the new Hanford (Wash.) plutonium reactor has been soundly beaten in Congress. The Senate conceded after the House had thrice voted down the $95-million proposal and attendant compromises.

We are wholly convinced that defeat of the Hanford bill is in the public interest and that Congress has acted wisely. We have an especial admiration for that small band of House members who fought a clean and unrelenting fight against the Administration plan.

We may properly pass out a few other plaudits:

—To those members of the Congressional Committee on Atomic Energy who prepared the minority views. These views, in clear, simple language, contributed greatly to the defeat of the Hanford facilities.

—To those electric utility executives who came to understand the seriousness of the issues involved and devoted personal time and effort to bring their views to their legislators in Washington.

—To those of the coal industry who came to understand the issues involved and who would not be compromised by the legislative offer of $5 million for atomic research connected with the coal industry.

—To interested citizens around the country who bothered to study the facts of this proposal and to convey their views to their congressman.

But while the investor utilities can be encouraged by the outcome of the Hanford proposal, this is not a time for cheering. On the same day that the House voted down the Hanford measure for the third time, it approved by a similar margin funds to initiate construction of an all-federal network in the Upper Colorado River Basin.

Although the economics of the Hanford power facilities would seem to be even less favorable with the passage of time, we have little doubt that federal power advocates will revive this proposal for another legislative try next year.

Upper Colorado Transmission—Still a Chance

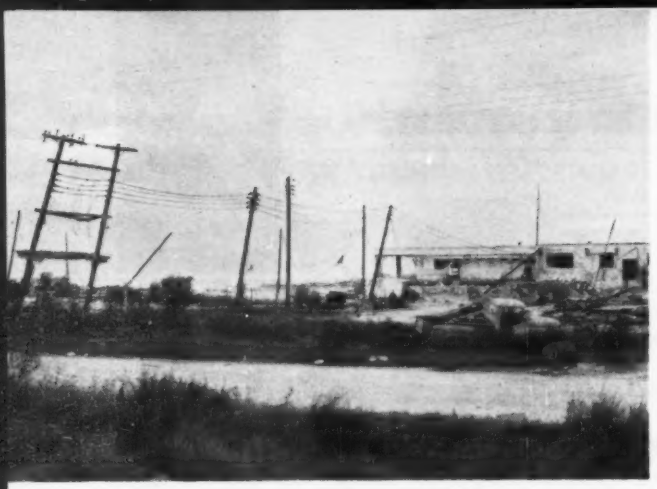
The five investor-owned utilities in the Upper Colorado Basin still have a fighting chance to provide a transmission network for wheeling government power in their service areas.

Their opportunity hinges on strong language in the Senate Appropriations Committee report accompanying the funds bill which provided $13.7 million for the Bureau of Reclamation to build federal transmission lines in the Basin. Only $5.7 million of these funds would be used for lines that are being contested by the investor utilities, and the Senate Committee directed that use of the $5.7 million be withheld until the Bureau of Reclamation has "exhausted every possible effort" to negotiate wheeling agreements with the five investor companies. The Committee further directed the Bureau to report back on the progress of its negotiations no later than next February.

The House had earlier voted the funds with no restrictions.

The bill voted by the Senate could, in effect, give the Bureau a club to take to the negotiating table.

But if the Interior Department and its Reclamation Bureau pay heed to the strong words of the Senate Committee, the investor companies still have a chance.



Hurricanes: East Braces, Gulf Digs Out

EXTENSIVE COASTAL FLOODING prevented crews from approaching trouble spots. Scenes like this were common

As East Coast utility men braced for onrushing Hurricane Esther, the Texas Gulf Coast totalled the damage from Carla and found it more than first guesses indicated. First reports (EW, Sept. 18, p 100) had indicated relatively little utility system damage, but receding flood waters have left evidence of greater destruction.

Hardest hit were the cities of Galveston and Freeport, both served by Houston Lighting & Power Co, which reported 200,000 customers affected by outages. Freeport was completely flooded after the sea-wall gave way. Galveston was ripped by two tornadoes within hours after the peak of the hurricane, and lost service entirely for at least 36 hours. A small generating plant was knocked out by floods.

In the Houston area, several steel towers went down plus some H-frames on transmission lines and a "substantial number" of 12-kv lines.

East Awaits Esther

Esther seemed to have spared the Carolinas as she moved up the East Coast, but utilities farther north were making final adjustments to disaster plans as *Electrical World* went to press. Long Island Lighting Co had its entire force on standby orders and was awaiting crews from Commonwealth Edison and Consumers Power.

Consolidated Edison laid out plans for some 4,700 employees, and operating executives prepared for allocation of personnel. Riverside steam stations were sandbagged, and automatic 12-hr shifts were to go into effect if the storm hit.

Baltimore Gas & Electric Co set up decentralized service centers in community and fire halls equipped with maps and phones. Spinning generation was increased and maintenance postponed.

Atlantic City Electric Co ran its hurricane alert program on Sept. 19 as a dry run in advance of the storm. The developing course of the storm, though, led Atlantic City observers to believe that it would be spared the worst of the storm. Nevertheless, all substations were manned and extra line crews put on.

United Illuminating Co tested its disaster plan a month ago. Emergency distribution maps were available, and extra telephones and portable generators were on hand. Aluminum dykes were readied for flood control at generating stations and extra pumps brought in.

Philadelphia Electric Co reported its emergency procedures ready for the hurricane. Utilities as far west as western Ohio were alerted, and they in turn, alerted 250 linemen for possible shipment to Philadelphia.

In the Southwest, recovery procedures from Carla went ahead as rapidly as slowly receding flood waters would permit. Houston L&P's hard-hit territory received help from other Texas utilities.

HL&P borrowed crews from Dallas Power & Light Co, Gulf States Utilities Co, and Texas Power & Light Co. Tree-clearing crews were recruited from all over the southwest.

Working from first light until dark, HL&P was able to restore all service to Freeport one week after the storm. In Galveston, all primary lines were in operation a week after Carla, with service restored to all customers ready to accept service within ten days of the storm.

Main problem facing crews in water-front areas was flooding. But on a systemwide basis, HL&P reports that falling trees were the biggest problem.

During the height of the outage, the utility made special efforts to keep service going, or restored quickly, to hospitals, water pumping facilities, and medical cases.

Central Power & Light Co had as many as 15 to 20% of its customers in Corpus Christi without power at one time. Outages varied from a few minutes to several days. Corpus Christi was on the western edge of Carla where winds were not nearly as violent as in the center.

Blackout Hits 13 CP&L Towns

The morning after hurricane Carla, 13 towns were completely out of power. Major damage to the CP&L system occurred in Victoria, Palacios and Port Lavaca. On one 12-kv line near Palacios, 80 poles were knocked down. A substation at Palacios was taken out and the town was without power for three days until a portable substation could be moved in. It was impossible to move the equipment in sooner because highways were under water.

One 69-kv line between Victoria and El Campo lost 35 structures. The town of Edna, between Victoria and El Campo, practically had to have its electrical system rebuilt. Thousands of customers in other towns were also out of service for varying periods as a result of smashed distribution lines and broken wires. Breaks occurred in the 69-kv lines from Sinton to Refugio, and from Refugio to Tatton.

Despite the severity of the dam-

age, CP&L was back in operation three days after the storm. Only two very small towns of Ganado and Louise were still without power.

CP&L tried to restore service on an area basis unless there was a genuine emergency. All the utility's local sales personnel went to the company's service centers and prepared meals for the crews. These were delivered to work locations to keep the crews on the job. The utility was able to restore service without outside assistance.

Community Public Service Co suffered damage to its system in Texas City, La Marque, West Columbia, Angleton, Alvin, Sweeny and Dickinson. Most of the damage was caused by water.

Gulf States Utilities Co had a relatively easy time with hurricane Carla. There were never more than 3% of its customers without service. Outages were due mainly to local distribution trouble. Most of the system was back within 12 hours except in low-lying areas which could not be reached because of high water.

Port Arthur, which the company serves, was 95% evacuated in advance of the storm. Carla veered away from the city and damage there was slight to utility lines. The company picked up lines as they went down and had service restored by the time people returned to town.

Utilities had ads in local newspapers telling customers that repairs were in progress. CP&L ran spot radio announcements suggesting that people with food freezers use dry ice and telling them where to purchase it. Follow-up newspaper messages asked customers to call if services weren't restored.

Electrical equipment manufacturers have put their facilities at the disposal of utilities in the hurricane struck areas.

New England Plans 400-Mile, 345-Kv Line

A 400-mile, 345-kv line will be built across New England as part of the region's billion-dollar generation and transmission expansion during the present decade.

The new line (see map, EW, Sept. 11, p 43) will extend from New York State just north of New York City, through Connecticut and Rhode Island, upward into Massachusetts, then in two directions, southeasterly to Cape Cod and northerly through Massachusetts and New Hampshire into Maine.

Between 1965 and 1970, it is expected that about a half-dozen large thermal units will be installed in the region, with at least one, and probably two, being atomic plants.

Also scheduled for construction in New England are nearly 1,000 more miles of 230 and 115-kv lines.

Carolinas–Virginias Power Pool Formed

A power-pool contract has been signed by four utilities in the Carolinas and Virginias: Virginia Electric & Power Co, Duke Power Co, Carolina Power & Light Co, and South Carolina Electric & Gas Co (see map).

Under the contract, detailed plans for pooling generating capacity and coordinating transmission line construction must be worked out by Jan. 1, 1963. The participating companies are already committed to the purchase of generating facilities for the immediate future, so pooling will affect only later construction.

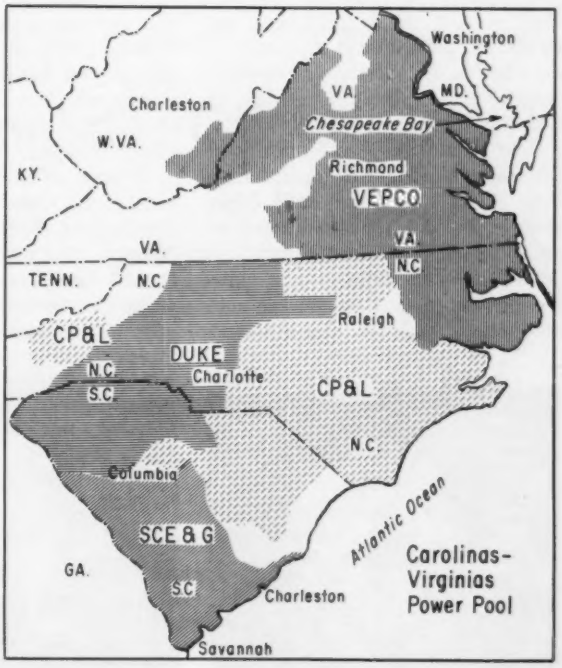
Operating as a pool will permit maximum use of recent technological developments "to attain even greater security and economy of service," the companies say. Units on the order of 500 Mw or larger are contemplated for the pool, and the economics of plants in the 1,000-Mw to 2,000-Mw range will be studied. The largest unit now on order by any of the companies is 350 Mw.

In order to move the large blocks of power required by the pooling arrangements, the companies are contemplating building a 460 to 500-kv grid over their present 110 to 230-kv systems.

The companies are already interconnected, but maximum voltage of these ties is 230 kv.

Probable first step in the 500-kv system will be the transmission tie between a mine-mouth plant that Vepco has announced for a West Virginia site and the company's northern system. Initially, this tie will consist of two 230-kv tower lines that will be designed for inexpensive conversion later to bundled-conductor, 500-kv operation.

Other lines that will form part of the 500-kv grid will also probably operate initially at 230 kv.



In addition to the pooling plan, Vepco is considering ties with Potomac Electric Power Co on the north and Allegheny Power Co to the northwest, as well as strengthening existing connections with Appalachian Power Co. At the present time, there is also a plan for connecting Appalachian's 345-kv system to Vepco's system, plus a lower voltage connection soon.

Utilities Win Upper Colorado Reprieve

Senate unit approves $13.7 million for federal transmission lines, but contested $5.7 million has strings attached

Five mountain state power companies who have been battling a major federal power grid for the Colorado River project appeared last week to have won an 11th-hour, five-month reprieve in their bid to negotiate an alternate wheeling agreement with the Bureau of Reclamation.

The Senate Appropriations Committee approved about $5.7 million to start work on the big, controversial federal lines from the Upper Colorado dams to major load centers.

Another $8 million was approved for lines connecting federal projects. These lines were never in dispute.

But the Senate committee added a proviso that none of the $5.7 million would be spent on the contested lines before February 15, 1962—when the Interior Department must report to the Senate and House Appropriations Committees on whether it and the five utilities were able to negotiate a satisfactory wheeling agreement.

The whole gamut of arguments for and against federal transmission lines at the Upper Colorado River Storage Project were presented to an earlier Senate hearing.

Reclamation Commissioner Floyd Dominy, appearing before the subcommittee, laid out the Bureau's plan to build nearly $200 million in federal transmission lines—both the non-controversial "integrating" lines and the contested lines to major load centers.

Dominy re-stated his previous arguments, which he gave earlier to the House Appropriations Committee in closed session, that: **(1)** The federal lines plan "is a long established policy and practice of the government;" **(2)** The utility offer "will not meet the requirements of Principle 4 (in the Bureau's list of 5 principles) or the requirements of the (Colorado River Storage) Project Act;" **(3)** The utilities' alternate would cost about $300 million more over the 86-year payout period.

Dominy emphasized, however, "I am satisfied that the main reason the private utilities are so anxious to construct the essential two-thirds of the transmission system is to gain control of the power, not only without charge but under the added indignity of forcing the government to pay wheeling charges while they obtain for themselves the great values inherent.

Defense of the utility plan came principally from President Walter Lucking of Public Service Co of Arizona. With him were President E. M. Naughton of Utah Power & Light Co, President D. W. Reeves of Public Service of New Mexico.

"The utilities' combination plan provides 50% more transmission capacity in Arizona, and 100% more transmission capacity in the states north of Glen Canyon," Lucking said.

"The use of investor-owned transmission facilities in combination with certain federal lines . . . is in harmony with long-established policy of Congress and federal agencies in marketing power from federal projects," Lucking continued, "and he cited the following advantages to acceptance of the utility plan:

(1) Everything required by the (Upper Colorado) project's authorizing legislation would be accomplished in accordance with Congressional intent; **(2)** The nation's taxpayers would be relieved of the expenditure of at least $134 million in federal transmission lines costs at a time of large federal deficits due to necessary defense spending; **(3)** The heavy cost of power facilities would be repaid to the federal treasury at least seven years earlier, thus making more money available earlier to the states for irrigation assistance; **(4)** Project revenue would be increased by more than $1 million annually through elimination of heavy line losses on the Bureau's proposed transmission system; **(5)** The utilities would pay federal income taxes of over $1 million per year on revenues received from wheeling project power. In addition, the utilities' transmission lines associated with delivery

DOMINY: Utilities want control of the power without paying the charge

LUCKING, NAUGHTON, REEVES: Utility plan is in harmony with long-established policy of Congress and of the federal agencies.

of project power would produce increased state and local taxes of over $2 million per year, including over $1 million for the support of schools. The Bureau's system would pay no taxes; **(6)** Preference customers would be assured of better electric service through use of a multipurpose transmission system connected to all major generating sources in the region; **(7)** Use of the existing and planned transmission systems of the utilities (important to the over-all effectiveness of the total power supply) would provide, without additional cost, substantial interconnection with all the large power pools in the western U. S."

Naughton not only defended the advantages of the utility wheeling offer, but accused the Bureau of Reclamation of planning the federal grid to invade his territory:

Dominy, under subcommittee questioning, said that the comparison of costs, actually, was immaterial—that the economics of paying wheeling charges would fail to build up a reserve for irrigation in the Colorado River fund.

Modifications in the Bureau's original "yardstick" federal grid plans were admitted by Dominy, but he said, "These modifications are basically in the fringes of the system and there will probably be others before we are through."

Harvey McPhail, executive director of Colorado River Basin Consumers Power Inc. (the preference group), led the testimony of nongovernment witnesses who spoke for the all-federal lines before the Senate subcommittee. McPhail, a former assistant reclamation commissioner, hit the power companies for fighting the all-federal plan, and then chided the utilities for trying to meet the Bureau's power costs when they (the utilities) have inherent costs—such as taxes and profits—which the Bureau doesn't have.

"The private utilities have waged a tremendous campaign to achieve their desires," said McPhail. "They are spending literally hundreds of thousands of dollars in newspaper and magazine advertising, propaganda, leaflets, door-to-door campaigns and other activities to sway local and national feelings. Now, why is this? We are dealing with monopolistic, profit-making organizations who approach these matters from a cold, business standpoint."

Westinghouse Sues TVA

Westinghouse Electric Corp has filed a countersuit totaling $31.8 million against Tennessee Valley Authority in answer to a $20-million suit by TVA against the company. The company also denies it owes the $20 million to the agency as is contended in the suit TVA filed in Chattanooga federal district court last July. Both suits are in connection with 16 turbine-generators of 150 and 250-Mw size that Westinghouse supplied to TVA for the Gallatin, Kingston, and Shawnee steam plants.

In the original suit, TVA charged that the units did not meet specified heat rates and that as a result of defects and outages TVA had excessive fuel costs and loss of revenue from power sales (EW, July 17, p 36).

In the countersuit, filed Sept. 15, Westinghouse asks "in excess of:" (a) $17,760,000 "by reason of excess kilowatt capacity in the electrogenerators supplied, with the consent and inducement of plaintiff (TVA) over that specified by the contracts" and for the further reason that TVA used the excess capacity; (b) $4,784,835.07 for balance due on the units and spare parts; (c) $8,785,171 for improvement made in the value of the turbo-generators at the instance of TVA, the amount representing the extra expense these improvements cost the company, (d) $341,787 for spare rotors held at the disposal of TVA.

In a separate portion of the Westinghouse reply, the company denies TVA's original allegations, but asks that a credit of some $29 million be applied to the company, should it be found liable to TVA's claims. This sum comes from the $17-million excess capability claim above, the spare rotor claim, some $8 million for expenses incurred in improving value and performance of the units, and finally, almost $3 million for the "extra expense" Westinghouse was put to by "reason of delays" and "interference" while it was completing the contracts.

Ross Named FPC Commissioner

President Kennedy has named Charles R. Ross, a Republican, to fill the vacancy on the Federal Power Commission created by the death of Fred Stueck. And the Senate Commerce Committee, hoping to get Ross confirmed before the end of this session of Congress, scheduled a hearing on his nomination late last week.

Ross, chairman of the Vermont State Public Service Board since 1959, is the fourth man named to the FPC this year by President Kennedy—a record number of appointments for any one year by one president.

Ross would be the second GOP member of the FPC; Commissioner Jerome Kuykendall—former chairman under President Eisenhower—is the other. Ross' term will expire June 22, 1964. Kennedy earlier had named three Democrats to the FPC: Chairman Joseph Swidler, Commissioners Howard Morgan and Lawrence O'Connor.

Ross is a graduate of the Michigan University Law School, and, prior to his term as chairman of the Vermont board, he was an instructor at Oregon State University.

Senate Gives Up Fight For Hanford Facilities

Without the controversial $58-million provision for Hanford NPR generating facilities, the Senate gave in to the House and approved the $276,500,000 Atomic Energy Commission Authorization bill. (EW, Sept. 18, p 98).

The bill was then to go to President Kennedy for his signature.

The end of the Hanford fight this year came after the House had twice refused to accept any authorization for the generating facilities, even though the second time around the proposed facilities had been scaled in half. After the second go-round, the Senate abandoned its fight for the facilities.

ELLIS: ". . . electric power . . . is wherever it is needed . . ."

CLAPP: ". . . be sure there are ground rules to protect you"

NRECA Regional Meetings Start

The traditionally hard attitude of National Rural Electric Cooperative Assn leadership toward investor-owned electric utilities is bolstered this year by tough-sounding representation from the "New Frontier." This was evident as the annual series of NRECA regional meetings opened at Eau Claire, Wis., with NRECA General Manager Clyde Ellis and REA Administrator Norman Clapp taking the rostrum to promote the cooperative concept, and to warn that co-ops are ". . . threatened by mounting attacks from the outside."

Clapp is using the regional meetings series as a vehicle for reiterating his "third criterion" for making REA G&T loans, i.e.," . . . proposes to make loans for generation and transmission as an alternative for borrowers that are unable to buy power on fair or reasonable terms or that find themselves forced to rely on a hostile source for their future power supply."

With enthusiastic applause from more than 600 delegates and wives showing endorsement of his strongest statements, Clapp said it is bad business for cooperatives to "depend upon any power company which invades a borrower's territory or pirates away customers. Neither do we think it wise to do business with a supplier which joins in the campaign of vicious misrepresentation designed to undermine the position and acceptance of our cooperative systems in the eyes of the public. Electric power is the life blood of a distribution system. We cannot afford to depend upon a borrower's avowed enemies to provide it."

Clapp also warned that ". . . growing encroachment on co-op service areas is not confined to isolated instances. You may think your particular co-op is safe now, but . . . your turn will come, and you had better be sure that when that time comes, there are ground rules to protect you." Clapp asked for state legislation for territorial protection.

Important to National Security

"I think it's absolutely true that America's investment in rural electrification and natural resources would be fully justified on the basis of national security alone, aside from the multitude of other human and economic benefits which have flowed from these programs," said Clyde Ellis as he related the rural electrification program to national security.

"Because of you," he told the group, "electric power is out there wherever it's needed in America. A pattern of strength, of diversity, exists which would never have been possible without this program." He also said:

"Your pattern of consistent support for the resource programs which have helped make America strong has almost been balanced through the years by power company opposition. It's time this opposition be exposed to the light of day—something it cannot stand."

Ellis reported that the NRECA board of directors has authorized NRECA management to request three-year pledges of support from individual systems for the TNT (Tell the Nation the Truth) advertising program in order to permit longer range planning.

About the ad program, Ellis said, "It tells the nation the truth, in contrast to the distorted ads of the power companies."

Some of the aims of the NRECA advertising program were laid out by Harvey M. Schermerhorn, director of public relations for the Wisconsin Electric Cooperative. He said socialism is highly nauseating to the public mind, and accused electric company copy writers of identifying co-ops with public power. But, he said, the public has not fully accepted this information from a "greedy monopoly."

Schermerhorn said the mass mind will not read socialism into fair rates, adequate service, and improved management that make up the image of co-ops.

The importance of good public relations on the local scene was emphasized by Schermerhorn. He said the nature of acceptance of co-ops by other local businesses, labor organizations and social groups depends much on the individual cooperative's own business practices. He believes that education of co-op members to the public relations problems is an effective way to get good local public relations.

Rural area development is a prominent part of NRECA discussions this year.

There are two rural area development programs that can be used by co-ops to broaden their base loads; one under the Department of Agriculture, and the other is the new Area Redevelopment Administration program under the Department of Commerce. The second lends assistance only to depressed areas, but the first is available to all co-ops.

Urges Relaying For Tree Faults

CEI speaker tells AIEE at Salt Lake City that 'quick-trip' scheme fails to allow for tree breaking contact and offers modification

OFFICIATING at AIEE meeting were, left to right: J. D. Stephens, Salt Lake City chairman; H. B. Hodgins, meeting chairman; W. H. Chase, attending first meeting as AIEE president; and R. A. Radford, meeting co-chairman

A change in the "quick-trip" scheme for two-cycle breakers reduces distribution conductor burndowns caused by contacts with trees, the American Institute of Electrical Engineers was told at its recent Pacific General Meeting at Salt Lake City, Utah.

C. M. Shuster, Cleveland Electric Illuminating Co, in proposing the change, pointed out that the quick-trip scheme fails to allow for a tree limb breaking its fault-making contact. Hence, the fault is not cleared by one instantaneous tripping, he said, but persists until the second tripping, delayed so long that the conductor burns down.

In the modified scheme, the first instantaneous tripping, the response to a transient fault, would be followed by instantaneous reclosing. A second tripping, also instantaneous, would clear the fault, but would be followed by delayed reclosing. The instantaneous unit, he said, would then be blocked, the circuit being left capable of time-delay tripping only.

New Machine Needed

C. K. Grant, California Electric Power Co, noted that today's oscillographs at key substations and power plants require considerable maintenance, particularly the galvanometers.

Grant cited a need for a machine without the oscillograph-lamp and galvanometer problems. The machine, he said, should have static components for greater stability and longer life and should be capable of recording for a few cycles before a system disturbance.

He was answered by delegates on the floor, who said that such a machine is already available from a French manufacturer at reasonable cost.

Tests demonstrate that today's 220-kv suspension-bus design can withstand a 10-million-kva short circuit, said H. M. Stone, Southern California Edison Co.

Stone's presentation included a motion picture showing the magnetic forces between bus conductors when high short circuits were imposed. The tests were on a full-size, 220-kv, twin-bundled-conductor suspension bus subjected to 3-phase short circuits of various magnitudes and durations.

The utility performed the tests in the anticipation that 220-kv short-circuit duties of 26,300 amp may at least double at system spots in the next decade.

Results of a digital computer study permit comparison of symmetrical 3-phase fault currents with parameters assumed in calculations, said R. B. Shipley, Dorothy Coleman, and W. L. Nason, all of Tennessee Valley Authority.

Results of the study, they said, afford a guide for evaluating errors arising from assumptions made to simplify calculations. The study investigated how loads, generator voltage magnitudes and angles, and line-charging currents affect bus fault currents.

Turbines at Sheldon Station of Consumers Public Power District, Neb., where the Hallam Nuclear Power Facility is under construction, will eventually receive steam from both conventional and nuclear boilers, said C. L. Dunsmore, Atomics International. The station began operation recently with steam from coal-fired boilers.

Upper Limit Not Yet Reached

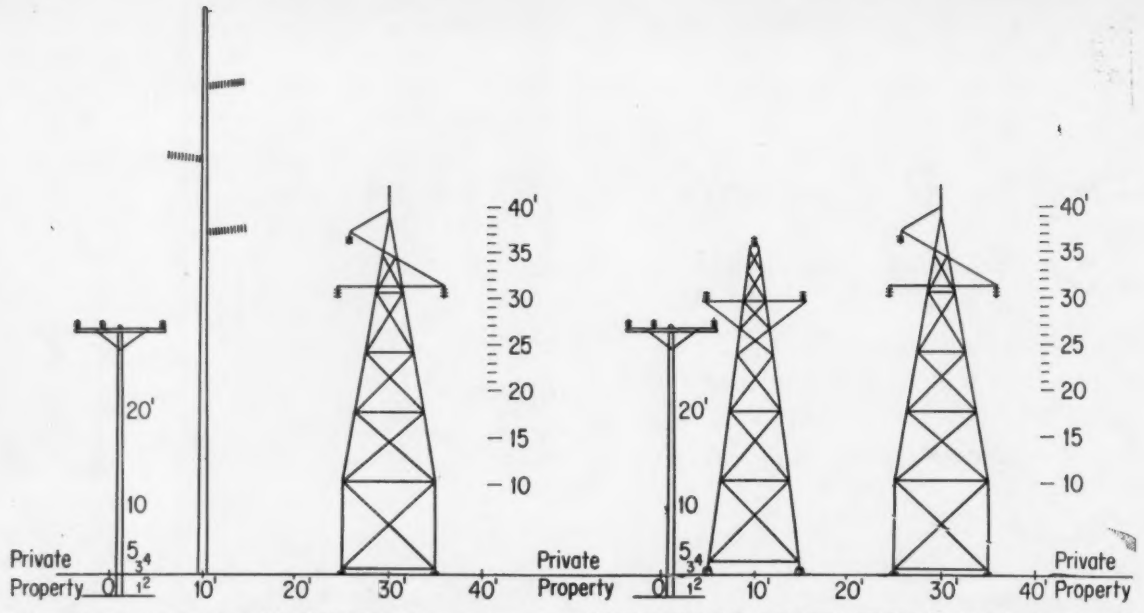
The steam from the sodium graphite reactors at 800 psig, 825F, and possibly at 850 psig, 900F later, does not reflect an upper limit. HNPF is expected to be able to produce 1,450 psig, 870F steam when the superheater has been redesigned. Atomics International, according to Dunsmore, plans operation at 2,400 psig, 1,050/1,000F with once-through boilers by 1965. By 1970, the reactors' operation will be supercritical.

The latter step is practicable, said Dunsmore, because sodium has a high thermal conductivity—five to ten times that of mercury—which can be combined with low vapor pressure at operating temperatures from below ambient up to 1,600F.

A flat spring washer of type 420 stainless steel compensates for differential thermal expansion and initial conductor deformation in connections with aluminum conductor, reported G. L. Flynn and T. L. Rundlett, Anderson Electric Corp.

They developed this solution for users of bolted aluminum connectors in their investigation of dimensional change, called relaxation, caused by

(*Continued on page* 84)



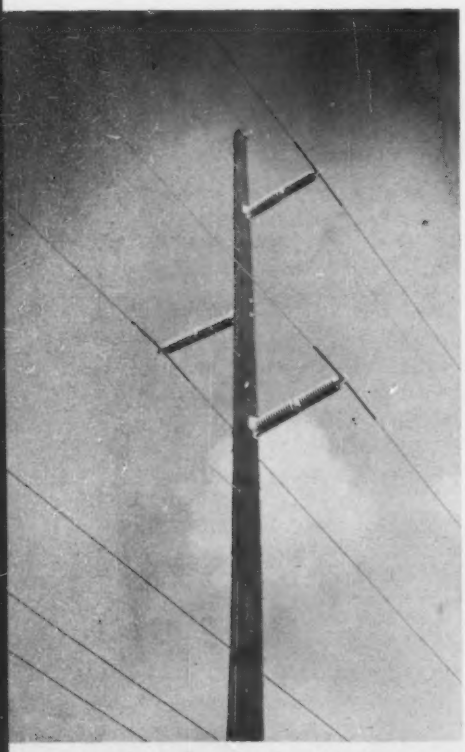
HORIZONTAL-INSULATOR CONSTRUCTION overcomes obstacles of constricted space and nearby overhead facilities

CONVENTIONAL CONSTRUCTION for 115-kv line in mid-right-of-way overhangs neighbors, impinging on clearances

Horizontal Insulators Squeeze

Design evolved for higher voltage gives RG&E trim-looking wood pole line fitting narrow R/W shared with other lines

HARRY G. SADDOCK, Technical Engineer, Rochester Gas & Electric Corp, Rochester, N. Y.



115-KV FEEDER LINE is trim and reaches above neighboring crossarm lines

Horizontal insulators enabled Rochester Gas & Electric Corp to squeeze into a narrow, crowded right-of-way the 115-kv line that taps the New York State Power Authority's 345-kv transmission line. The utility, like most of those serving heavily populated industrial areas in upstate New York, had contracted for Authority power.

To obtain the power, RG&E needed a 115-kv line where the available right-of-way was not only constricted, but occupied by overhead lines and their associated structures. No alternative route presented itself. The usual 115-kv construction would have overhung existing lines, impinging on their clearances and creating an unsightly clutter.

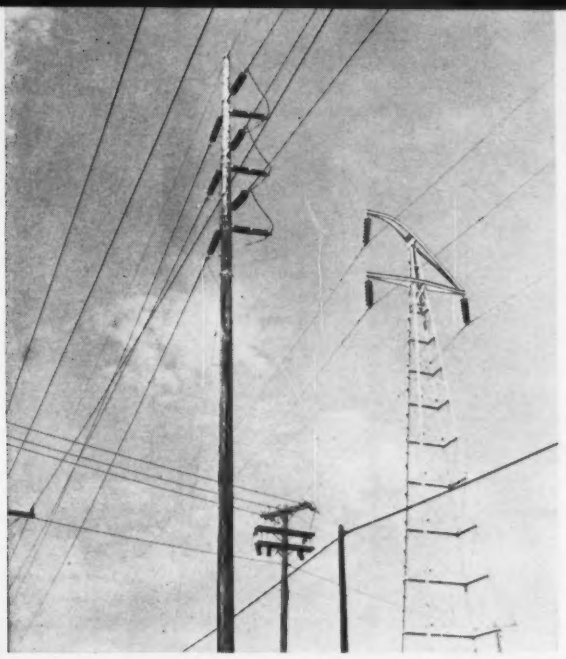
The PASNY EHV trunk line south of Rochester is at one point only five miles from one of the company's transmission loops on the city's outskirts. The loop starts at Russell Station and runs south and west to Elmwood Substation. The latter was designated as the logical point for receiving PASNY power.

The RG&E plan included a substation near the 345-kv line, which ties the Niagara and St. Lawrence projects, and a 115-kv feeder for bringing the power into its own system. Its execution at first seemed routine. The problems appeared when construction had begun.

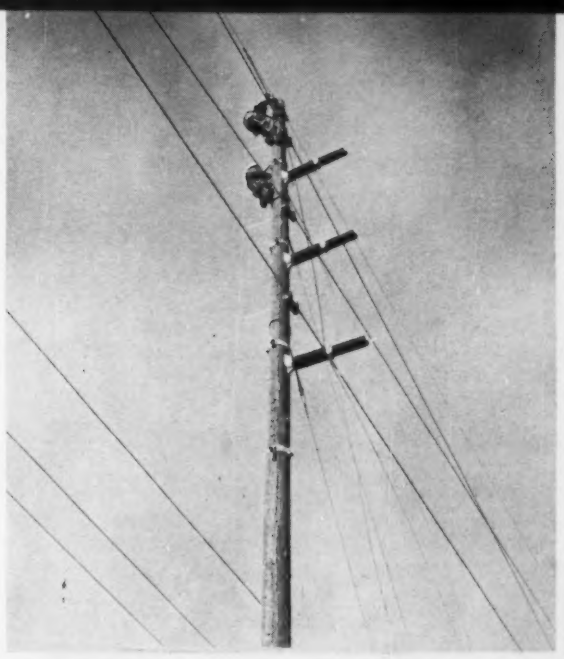
Three miles of double-circuit, 115-kv transmission line tied the substation under the PASNY 345-kv lines to Mortimer Substation. At that point an additional interconnection to the Niagara Mohawk Power Corp cross-state line was made. Extension of two 115-kv lines from Mortimer Substation north to Elmwood Avenue Substation set the problem.

Between the substations the right-of-way is only 40 ft wide most of the distance. Along three miles on the left, it adjoins the Lehigh Valley Railroad right-of-way. The latter, in turn, borders a residential and park area for the entire distance.

On the railroad side of the utility's right-of-way is a 34.5-kv, wood-pole, crossarmed, clamp-top line-post circuit. On the other side of the scant 40-ft right-of-way is a 115-kv steel wishbone structure carrying a suspension circuit. Down the mid-



DEAD-END POLE in new line has horizontal post insulators on the jumper side of the pole. Proximate line is at 115 kv



LINEMEN secure shield wire. Behind them is offset ground-wire downlead, 21 in. from the pole's surface

115-Kv Feeder Into 40-Ft R/W

dle, between these lines, ran a 69-kv circuit on steel towers with pin-type insulators. An overhead communications cable on wood poles still parallels the 115-kv line.

RG&E scrapped the 69-kv line. Even with this done, 25 ft of right-of-way was lacking for a conventional 115-kv circuit. Neither more right-of-way nor a new route was available. The railroad stopped movement to the left; residential, high school, and university properties to the right. Cost put underground 115-kv pipe cable in the last-resort category, and replacement of the existing 115-kv circuit with a new double-circuit line was ruled out. The company could not complete its projected 115-kv circuit until means of further utilizing the right-of-way had been found.

RG&E had used horizontally mounted insulators for 34.5 kv, a construction which helped to gain lateral clearance on constricted right-of-way. Such horizontally mounted line posts eliminate the wide overhang of RG&E conventional crossarm transmission-line designs. The manufacturer gave 88 kv as the highest rating for this type of insulator.

Although it had developed the insulator for 20 through 88 kv only, the manufacturer, Lapp Insulator Co, was then experimenting with horizontally mounted line posts for 115 and 138 kv. It submitted a 115-kv design, a two-piece unit, 53 in. long from integral gain-base to clamp top head. The design was trim looking and needed only narrow lateral clearances.

Maximum Safety Sought

As a horizontal insulator carries cantilever loads continuously and must withstand considerable loading in tension, a maximum margin of safety was desirable in the design. These insulators' special porcelain has a strength rating of 2,800 lb cantilever. Each porcelain has a flanged cap cemented on one end for bolting the section in tandem. An integral gain-base, angled 5 deg for keeping the insulator slightly above horizontal, is cemented to the bottom. The curved base fits the contour of the pole and mounts the insulator to the side of the pole with throughbolts, top and bottom.

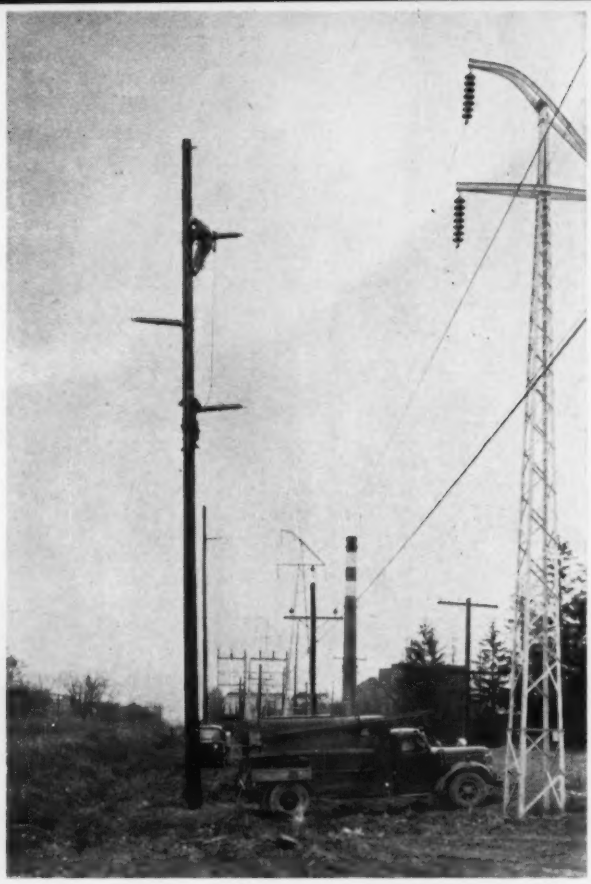
The conductor is secured in a trunnion-mounted clamp on the insulator's top cap. The assembled unit is 53 in. long from mounting base to center line of the clamp and is designed to meet or exceed the flashover values for a string of seven standard (EEI-NEMA Class 52-3) suspensions.

As the insulator is mounted horizontally, wet flashover is practically the same as dry flashover, all parts being wetted uniformly and independently of the direction of the rain. Contamination is washed from each petticoat, which then drains free while remaining clear of other petticoats. Tests found the insulator free from radio and television interference. RG&E approved the design on the basis of electrical and mechanical tests in the John Lapp High-Voltage Laboratory.

Construction began with removal of the old 69-kv circuit. Construction practices were then adapted to the new insulator design, most of the pole-top assembly being completed on the ground. Pole-top clamps to carry the static wire were mounted on each pole. Four plastic rods for offsetting the downlead were bolted to the pole, spaced 8 ft apart and centered in line 90 deg from the insulator side of the pole. These rods hold the downlead 21 in. from the pole's surface. In this way, the impulse level of the rod is over and above the insulation contribution of the 5¾ ft of pole wood.

The insulators were mounted on the pole, bottom section first. Then

GROUND ASSEMBLY was used wherever feasible. Here the wood pole is being raised with insulators in place



RIGHT-OF-WAY being only 40 ft wide, work on new 115-kv line was begun after 69-kv line had been scrapped

the top section for each of the three phases was mounted. Top and bottom phases are on the same side of the pole, the center phase being at 180 deg to the others on the opposite side. Insulators for each phase are 8 ft apart on the pole.

The narrow right-of-way, as well as the terrain, made erecting fully assembled poles dangerous in places close to the energized 34.5 and 115-kv circuits. In such places, a single insulator, or the bottom section only of each insulator, was mounted on the pole which was framed after erection. Most of the assembly, however, was completed on the ground—poles, insulators, and all being erected ready for stringing.

Class 3 wood poles 65 to 75 ft long constitute the line. These were imbedded 8 to 9 ft, the longer ones going deeper, and all were raked 18 in. to the west to compensate for the prevailing wind. Maximum span is 300 ft; average span 250 ft. Dead-end structures were placed at every major street crossing, so that they average two per mile, one every ten spans. These structures were guyed in line from two sides, rod type plastic strain insulators being used on the pole end of the guy.

Angles up to 5 deg were taken easily with the horizontal post insulators on regular tangent structures. Where greater angles were required, the dead-end structures were three-point guyed, and the angles were made from there.

Posts 8 Ft Apart

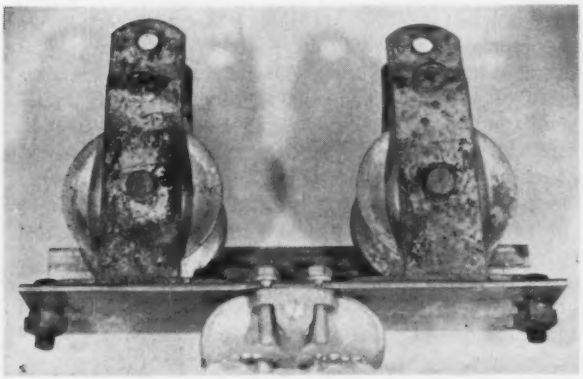
Three strings of eight suspension insulators (EEI-NEMA Class 52-3) were attached in strain position on each side of the pole in line with the circuit. The strain strings were attached to the wood with pole bands, one above the other and 8 ft apart. Conductors were secured with aluminum preformed dead-end grips, the ends cut to length and spliced with a compression sleeve to form the jumper.

Three horizontal line posts of standard-strength porcelain are on the jumper side of the pole, spaced 8 ft apart, as standoffs stabilizing the jumper loops. Downleads on dead-end structures are offset on the side of the pole opposite the jumper. Dead ends were installed by a crew working with standard tools and methods on a "diving board" platform.

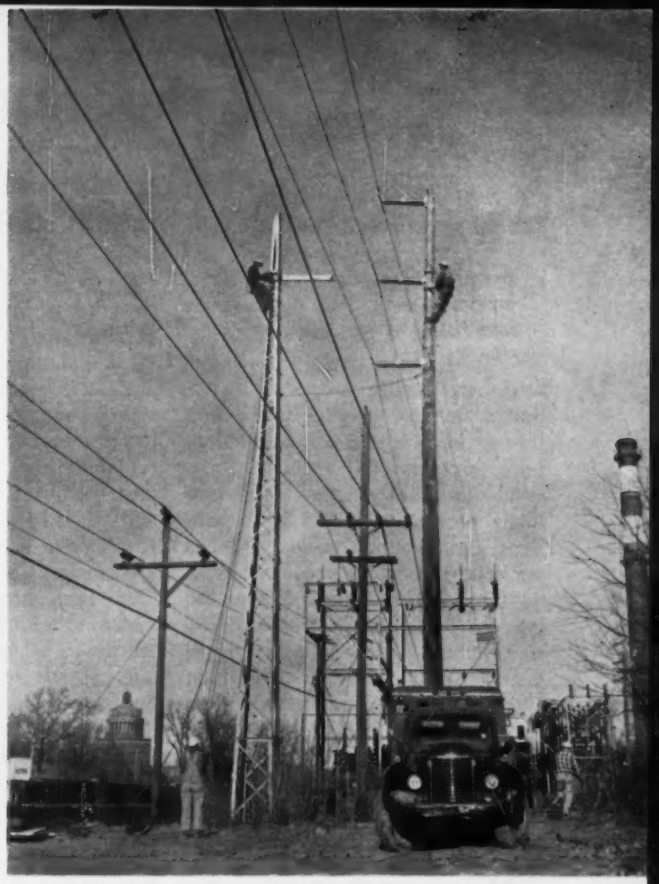
When the poles and dead-end structures had been set, guyed, and framed, stringing and sagging of the conductors proceeded much in the usual way for a 115-kv line.

The area has an isokeraunic level of 90. For this reason, and because of the height of the structures, both the double-circuit line into Mortimer Substation and the new armless circuit from Mortimer to Elmwood are shielded. The static wire on the armless poles is ⅜-in., Type C coated wire, clamped on each pole with a trunnion-type clamp like those on the clamp-top posts. These clamps are on a pole-top bracket bolted to the pole 8 ft from the top phase. The static wire is deadended at each dead-end structure and grounded at each pole. Stringing the static wire was completed before the No. 2 stranded copper ground wire was threaded through the offset rods and carried to ground.

INSULATOR is a two-piece unit, 53 in. long from the integral gain-base to the clamp top head, as shown



STRINGING BLOCK was devised and rigged in the field. Two standard sheaves were bolted to aluminum angle



ELECTRICAL CIRCUITS and other facilities are crowded into a right-of-way that could not be extended on either side

The ground-wire downlead puts 5¾ ft of pole wood in series with the porcelain, affording a combined impulse level of 1,250 kv for surface strikes. This level, exceeding the 1,160-kv air strike gap, improves protection to pole and insulators by confining impulse flashover to air strikes between the offset ground-wire downlead and a conductor. It also exceeds that of seven suspension units hung vertically, the standard for RG&E 115-kv transmission structures.

Shielding Angle 26 Deg

The ground-wire shielding angle of 26 deg is considerably less than that on suspension structures and will therefore reduce the number of conductor hits. The shield wire on this circuit down the middle of the right-of-way is expected to provide additional protection to the unshielded 34.5 and 115-kv circuits.

The double-circuit line into Mortimer is conductored with "Bluebell" 1,035.5-MCM, Class A, all-aluminum cable. At Mortimer a tee-tap was made and the conductor downgraded to "Arbutus" 795-MCM, Class A, AAC for the 115-kv armless circuit from Mortimer to Elmwood.

A stringing block was devised and rigged in the field from two standard 5-in. sheaves bolted to a 16-in. length of 3 x 4 x ¼-in. aluminum angle. The bottom section of the aluminum clamp-top clamp from one insulator was bolted midway on the bottom of the angle, and the clamp was then mounted on the trunnion cap of the insulator. This stringing block's double-sheave arrangement preserved the conductor from crimping or bending too sharply during stringing. The large cable conductor moved freely through the sheaves without scratches and was easily sagged in on each span.

Enough blocks were made to string all three phases a mile at a time. A single lineman removed the stringing blocks, attached to line guards, and made the seating and clamping of the conductor. A ground line secured to the pole top and handled by two groundmen lifted and positioned the conductor while the lineman armored and clamped it to the insulator. The line, being in a heavy NESC loading zone, is designed for ½-in. radial ice with 8-lb wind loading, twice the wind loading normal for the area.

Crossarms, a limiting strength factor on 115-kv construction, are replaced by the horizontal posts. Hot-line maintenance is no more complicated than on structures with arms: Only a single trunnion cap-screw has to be retracted and the conductor, with clamp attached, swung clear of the pole.

Aids Public Relations

To simple design, ease of erection, lower radio noise level, and low construction costs, another important advantage adheres — appearance, which is most important to RG&E's public relations. For here is a high-voltage line running down the middle of a crowded right-of-way, bordered by a city park, a university, a high school, and residential properties. And it looks like it belongs there!

Economic Conductor Sizing

By overlooking effect of losses on economics of distribution feeders, conventional design practices sacrifice big savings

F. F. GRAY, Supervising Engineer—T & D Standards, T & D Development Dept, Union Electric Co, St. Louis, Mo.

Comprehensive analysis of conductor sizes for primary distribution feeders leads to the conclusion that only three covered and four bare conductors will handle distribution loads economically. Use of these sizes can produce annual savings per mile of 3-phase feeder of from $490 to $2,350, depending upon the type of load served (Table I). It is estimated further that the 1960 peak primary loss on the Union Electric system would have been reduced about 5,300 kw had economically sized conductors been in place. This would have effected annual savings of about $235,000, applying the value of $44.77 per kw of peak loss developed in the study.

Other advantages from economic conductor sizes, though not evaluated, are improved regulation, increased ability to handle load diversions during emergencies, and smaller inventories of conductors and fittings. At Union Electric Co, an engineering design standard covering economic conductor sizing is now used in the design of primary distribution feeders. Economic sizing with regard to spacer cable installations and 34-kv subtransmission circuits is being considered and may be adopted soon.

Information in this presentation is illustrative of the potential savings and does not apply to a particular system. Yet it approximates the costs in the Union Electric analysis. And while the study pertains to 4 and 12-kv primaries, the method developed applies to any primary voltage.

Losses of Thermal Ratings Costly

The study shows that continuation of former distribution design practices would result in sacrificing large savings. Most distribution systems for many years have been designed with thermal and voltage limitations as the principal parameters. Thus condensers have been sized to carry the maximum current possible without raising the temperature above a certain safe value while maintaining acceptable voltage. This approach does not take into account the value of losses on the distribution system. Losses will be minimized by a larger investment in bigger conductors, or they will be maximized by a lesser investment in smaller conductors.

Economic conductor sizing employs that combination of primary system investment and primary system losses which results in the least over-all cost. In most cases it specifies larger conductors to serve given loads than have previously been used by Union Electric. But, as long as the annual charges on this additional investment are less than the annual cost of supplying the difference in losses, the larger conductor is more economical.

Annual Charges vs Losses Is Key

Annual cost of any primary feeder is comprised principally of the annual carrying charges on the investment and the annual cost of losses. Operating and maintenance expenses are relatively small and are about the same regardless of conductor size.

Annual investment charge for a feeder is readily determined from its installed cost by applying an appropriate annual carrying charge, which in the study was 13%. (This same annual carrying charge was used in the study for all facilities involved, on the basis of their original installed cost.) To determine installed cost, a typical one-mile primary feeder containing 41 spans with four corners was used for each conductor. All costs associated with construction were estimated in accordance with the company's established estimating procedures. Guying at corners was given particular attention, as it becomes an appreciable expense when conductors are the larger ones.

The cost of supplying the losses of a feeder has two major components, energy and demand. Each must be independently determined. Because only the peak feeder loss can be determined accurately, all charges in the study are based on peak feeder losses. Appropriate factors inserted into the formulas determine annual charges from peak feeder losses. To arrive at the annual energy charge, this formula was used:

Annual energy cost per peak kw of loss = average generation cost per kwhr x 8,760 hr x annual loss factor x loss allowance.

Primary feeder losses must be supplied from generation. Generation cost is the most costly increment on the line at that instant. Therefore it must be considered in determining the annual energy charge against each kilowatt hour of primary feeder loss. For most utilities this generation cost will be about 3 mills per kwhr.

Annual loss factor is the ratio of the average power loss over a year's time to the peak loss in that period. This study used average loss factors of 0.35 for residential feeders, 0.38 for mixed feeders, and 0.45 for industrial feeders.

Losses supplied to the primary distribution system incur additional losses as they flow through preceding elements of the system. Therefore, the cost of generating these additional losses must be charged against the primary losses. These additional losses are about 6% of the primary feeder losses. Thus, to supply 1 kwhr of primary feeder loss we must generate 1.06 kwhr. From the foregoing factors the annual energy charge determined for each of the three types of feeders is shown in Table II.

Demand Losses Important

It may be argued that the demand component is not valid and should be omitted. Although the demand losses associated with one installation might be quite small, the summation of these small losses over the years has a pronounced effect. The losses on Union Electric's primary distribution system have grown to where about 48,800 kw of generation, transmission, subtransmission, and substation facilities are needed to serve peak load

Offers Distribution Savings

losses. Therefore, the inclusion of a demand component in determining the cost of losses has a sound economic basis. To determine, the demand charge per kw of peak loss this formula was used:

Annual demand charge per kw of peak primary feeder loss = cost per kw of capacity x annual investment charge x peak responsibility factor x loss allowance x reserve factor.

The cost of losses depends on the point in the system where they occur. The demand charge formula must be applied to each separate element of the system because the factors in the formula are not the same for each element. The summation of demand charges for all elements of the system, preceding the primary feeder, is the annual demand charge per kw of peak primary feeder loss.

The demand charge for each element is determined by first finding the installed cost per kw of capacity for each element. The cost of the next capacity addition to be constructed, not the average cost of existing capacity, should be used. For the study, and typical for many systems, these capacity costs per kva were used:

Underground supply (to overhead feeders)	$3
Distribution substations	17
Subtransmission circuits	28
Bulk substations	10
Transmission lines	11
Generating plants	150

Not all primary distribution feeders have their peak demand at the time of the system peak. Since at times other than at the system peak excess capacity is available, it is valid only to charge for the actual capacity necessary to serve the feeder losses at the time of the system peak. Thus, the percentage of peak feeder losses at the time of system peak is the peak responsibility factor.

The Union Electric system has three basic types of feeders: Residential, which peak at night; mixed, which peak in the afternoon and again at a slightly higher value at night; and, industrial, which peak

Table I—Savings per Mile of Feeder Using Economic Conductor Sizing

Type of Feeder	Load, Amp	Conductor Size: Present Method	Conductor Size: Economic Sizing	Annual Savings[1]
Residential, distributed load	200	2 TBWP	336.4-MCM AA	$490
Mixed, distributed load	250	1/0 TBWP	336.4-MCM AA	840
Industrial, load at end of feeder	400	4/0 TBWP	556.5-MCM AA	2,350
Branch, load at end	100	6 TBWP	366.4-MCM AA	2,020

[1] Total per mile of 3-phase for carrying charges and losses, the latter including both kw demand and kwhr energy charges

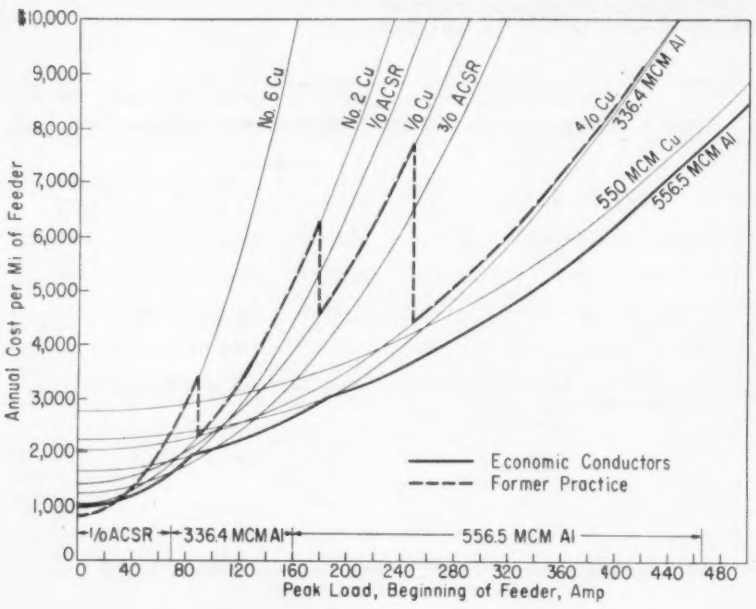
Table II—Annual Energy Charge—Per Kw of Peak Primary Feeder Loss

Type of Feeder	Cost/Kw	x	Hrs/Yr	x	Annual Loss Factor	x	Loss Allow.	=	Annual Energy Charge
Residential	$0.003		8,760		0.35		1.06	=	$9.75
Mixed	0.003		8,760		0.38		1.06	=	10.59
Industrial	0.003		8,760		0.45		1.06	=	12.54

Table III—Annual Demand Charge—Per Kw of Peak Primary Feeder Loss

Type of Feeder	Cost/Kw	x	Annual Invest. Charge	x	Peak Respon. Factor	x	Loss Allow.	x	Reserve Factor	=	Annual Demand Charge
Residential:											
Generation	$150.00		0.13		0.61		1.06		1.12	=	$14.12
Transmission	11.00		"		"		1.03		——	=	.90
Bulk Substation	10.00		"		"		1.02		——	=	.81
Subtransmission	28.00		"		"		1.01		——	=	2.24
Dist Substation	12.00		"		"		——		——	=	1.35
UG Laterals	3.00		"		"		——		——	=	.24
Total Annual Demand Charge per Kw Residential Feeder Losses											$19.66
Mixed:											
Generation	$150.00		0.13		0.85		1.06		1.12	=	$19.68
Transmission	11.00		"		"		1.03		——	=	1.25
Bulk Substation	10.00		"		"		1.02		——	=	1.13
Subtransmission	28.00		"		"		1.01		——	=	3.12
Dist Substation	17.00		"		"		——		——	=	1.88
UG Laterals	3.00		"		"		——		——	=	.33
Total Annual Demand Charge per Kw Mixed Feeder Losses											$27.39
Industrial:											
Generation	$150.00		0.13		1.00		1.06		1.12	=	$23.15
Transmission	11.00		"		"		1.03		——	=	1.47
Bulk Substation	10.00		"		"		1.02		——	=	1.33
Subtransmission	28.00		"		"		1.01		——	=	3.68
Dist Substation	17.00		"		"		——		——	=	2.21
UG Laterals	3.00		"		"		——		——	=	.39
Total Annual Demand Charge per Kw Industrial Feeder Losses											$32.23

Fig 1—Industrial 3-Phase Feeders—Load at End, Covered Conductors



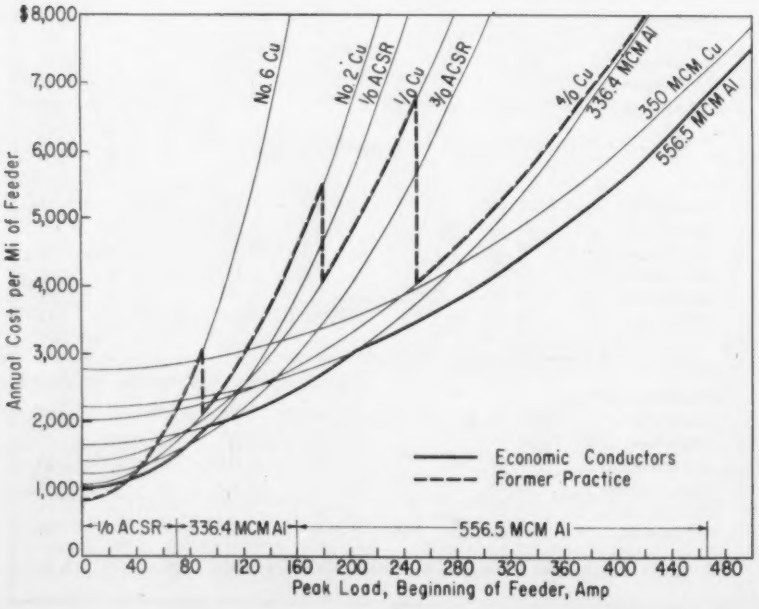
in the afternoon. Study of 104 feeders established these average peak responsibility factors: Residential, 0.61; mixed, 0.85; industrial, 1.

Losses in the primary feeders cause additional losses in all of the preceding system elements. It was determined that on the Union Electric system each kilowatt of primary feeder loss causes about 6% additional loss as it passes through the system. This 6% consists of 3% in transmission lines, 1% in bulk substations, 1% in subtransmission system, and 1% in distribution substations. Thus each kilowatt of primary distribution loss requires a loss allowance factor of 1.00 for distribution substation capacity, 1.01 for subtransmission capacity, 1.02 for bulk substation capacity, 1.03 for transmission line capacity, and 1.06 for generation capacity.

Although various considerations govern reserve generating capacity, the long-term average reserve capacity on the system approximates 12% of peak system load. Thus, for each kilowatt of peak loss a reserve factor of 1.12 kw for generating capacity should be applied.

From the above factors, the annual demand charges can be computed. Annual demand charges per peak kilowatts of feeder loss for each of the three feeder types are shown in Table III. A summation of the demand and energy charges results in the total annual loss charges listed in Table IV.

Fig 2—Mixed 3-Phase Feeders—Load at End, Covered Conductors



Losses Computed per Mile

To establish the losses in the various types of feeders throughout their load range, peak losses were computed for one-mile feeders using each conductor studied. In computing these losses, consideration was given to the increase in conductor resistance with load. Loading a conductor to its thermal limit increases its resistance as much as 16% above its no-load resistance. Thus, losses in a conductor actually increase faster than the square of the load.

In the study, feeder loadings were approximated by considering load concentrated at the end of the feeder and load evenly distributed on the feeder. Losses in a feeder with an evenly distributed load are exactly one-third those in the same feeder with the load concentrated at the end. It is necessary to separate most feeders into several sections, each of which approximate one of the two loading conditions.

The annual loss charges for each conductor are calculated throughout its load range by multiplying the annual cost per peak kilowatt of feeder loss by the peak feeder loss at loads throughout the load range of the conductor. Addition of this annual loss charge to the annual investment charge gives the total annual cost of the feeder.

Three of the 16 graphs developed in the study are shown here as Fig 1, 2, and 3. The graphs indicate the total annual cost per mile of feeder for each conductor size under the

various loading conditions. They show the most economical conductor for any given location and loading condition. They also indicate the feeder size which would be installed under thermal loading practices.

There are two other factors to be considered before the final conductor size is selected. It is not practical to stock all sizes of conductor. Sizes should be selected so as to obtain those which are economical over a fairly wide load range. In addition, consideration must be given to load growth in selecting conductors.

Charts Select Wire Sizes

Included with the cost curves are the recommended conductor sizes and the loading range through which they should be installed. The change in conductor size is made before the two curves cross because of expected load growth on the feeder. Otherwise, if the smaller conductor were installed at loads slightly lower than the crossing point, normal feeder growth would soon load the smaller conductor beyond its economical range. Actual points of change in conductor size allow for normal annual feeder growth of about 6%. At this rate of growth, a conductor installed at the lowest loading indicated will operate in the uneconomical range for five years. Thereafter it will operate in the economical range.

Analysis of the 16 graphs shows that only three covered and four bare conductors are required for economic sizing for the loads considered. Covered conductors are 1/0 ACSR, 336.4 MCM and 556.5 MCM aluminum; bare conductors are No. 4 ACSR, 1/0 ACSR, 336.4 MCM ACSR and 556.5 MCM aluminum. All-aluminum conductors are recommended as most economical where their strength is adequate.

To illustrate more clearly the effect of economic conductor sizing, the curves in Fig 4 were developed. Actual peak primary losses are plotted for 1950-1959. Peak primary loss trends are shown for both thermal loading practice and economic sizing for 1959-1969. The separation between these two trend curves, 5,300 kw for 1960, represents the annual peak primary loss reduction, had economic sizing been adopted at the start of 1959.

Fig 3—Residential 3-Phase Feeders—Load at End, Covered Conductors

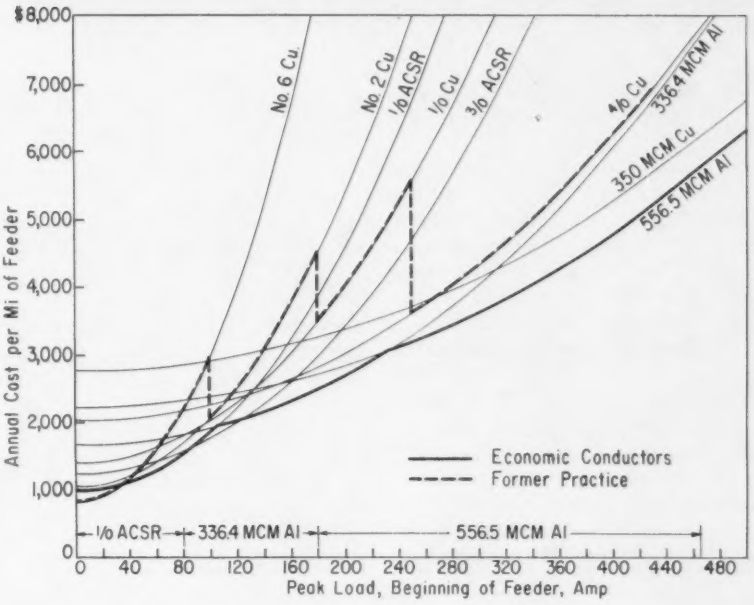


Table IV—Total Annual Charges Per Kw of Peak Primary Feeder Loss

Type of Feeder	Annual Demand Charge	+ Annual Energy Charge	= Total Annual Cost Per Kw of Peak Loss
Residential	$19.66	$9.75	$29.41
Mixed	27.39	10.59	37.98
Industrial	32.23	12.54	44.77

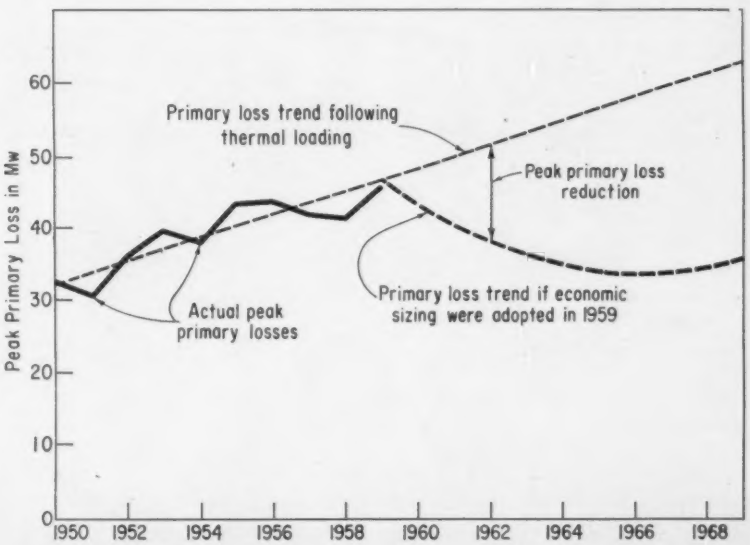


FIG 4—PEAK PRIMARY LOSSES would drop 5.3 Mw in first year had economic sizing been adopted at start of 1959 and this trend would have continued

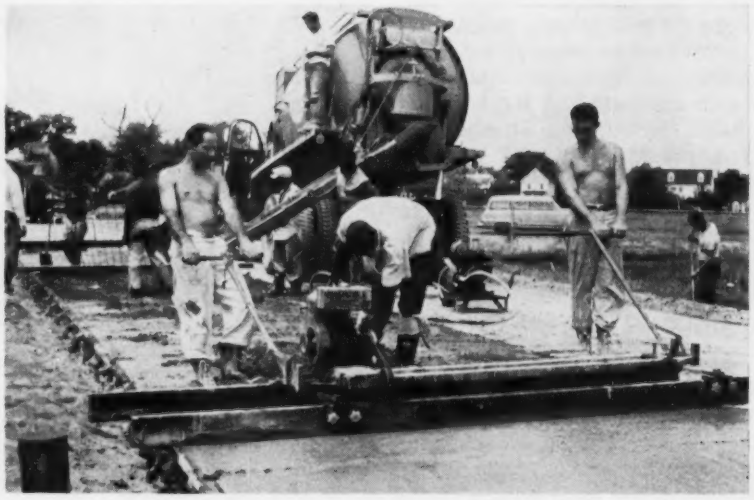
Flyash Concretes Meet Road Specs

F. M. REINHOLD, Consultant, Connecticut Light & Power Co, Berlin, Conn.

A year-old concrete roadway that has sections made with various proportions of flyash is demonstrating the practical worth of this pozzolanic material for highway construction. This roadway, which is the access road to Connecticut Light & Power Co's Norwalk Harbor Generating Station, was constructed under close control and as nearly as possible to Connecticut State Highway Dept specifications.

The results to date indicate that concrete mix with flyash and 5½ bags of cement produces a pavement superior to a regular 6½-bag plain concrete mix and that a 4½-bag flyash concrete pavement will meet standard highway specifications. Even a 3½-bag flyash concrete has definite potential in cases when traffic can be kept off the pavement for about 40 days. The results to date are summarized in the table.

Prior to roadway construction, various laboratory-design mixes were poured for each basic mix of 3½ to 6½ bags. Tests of these determined the job mixes for the roadway. This was constructed in July 1960. Following usual highway construction practices, the road contractor placed two layers with reinforcing wire mesh between, smoothed the surface with a mechanical reciprocating screed, finished with a burlap drag and cured under burlap cover for seven days by continuous sprinkling. Retired state highway department personnel inspected during construction to ensure compliance with specifications and that department's laboratories tested beam and cylinder specimens taken from construction batches.



SURFACE OF FLYASH-CONCRETE ROAD is smoothed wth a mechanical screed

The 14-day flexural beam tests showed that all mixes except the leanest, the 3½-bag mix, would qualify under the state highway department's requirement of 500 psi. At 28 days, all mixes, with the same 3½-bag exception, also met the American Assn of State Highway Officials class A requirement of 3,000-psi compression strength. The 3½-bag mix indicated it would reach these test strengths in 39 days; it would qualify as class B. Curves drawn from these tests plus those at 7 and 90 days (see table) show that the proportional increase in strength for all flyash mixes is equal to that of the control mix with no flyash (the 6½-bag mix) and that the 5½-bag mix increase is even greater. This was expected because past experience has demonstrated that after ten or 11 days flyash concrete increases in strength faster than plain concrete. Tests at 180 and 360 days showed relatively increasing strength of the lean 3½-bag mix.

A careful visual inspection of the road four months after installation showed all 40 sections to be in excellent condition. It was impossible to distinguish one mix from another by appearance. In all sections, only one very narrow, irregular crack occurring in a non-test mix.

Final conclusions on the results of the experimental road would be premature now. But tests indicate that flyash concrete with 4½-5% air entrainment is as effective as regular Portland cement concrete with the same air content. The real test is how the highway pavement stands up. A few years of rugged New England winters, with intermittent freezing and thawing cycles, may provide the ultimate and visual proof. Cores from the pavement should be tested and compared with the physical characteristics noted then.

This article is extracted from the booklet, *Experimental Fly Ash Concrete Road*, published by Conn. Light & Power Co.

Test Results on Flyash Concrete Used in Road

Design mix, Per Cu Yd		Average Modulus of Rupture, Psi Flexure			Average Compressive Strength, Psi			
Bags of Cement	Flyash, Lb*	7 Day	14 Day	28 Day	28 Day	90 Day	180 Day	360 Day
6½	None	587	650	682	3,950	5,280	5,330	5,790
5½	158	542	660	679	4,185	6,115	5,945	6,215
4½	130	427	525	564	3,460	4,750	5,160	5,510
3½	133	334	401	488	2,500	3,570	4,370	4,775
4½	128*	483	535	589	3,100	4,280	4,545	4,820

* Classified flyash except for last mix

S&C power fuses are going places

The power fuse has come a long way in fifty years —from S&C's liquid fuse to S&C's sophisticated, boric acid fuse of today. Now, with interrupting ratings up to 1,000,000 kva in the Type SM (720 amperes continuous), and 2,000,000 kva in the Type SMD (540 amperes continuous), S&C power fuses are being adapted to virtually every conceivable system protection need. Power fuses are used indoor and outdoor; enclosed and in the open; in plants and buildings; on transmission and distribution lines; on overhead poles; in pad mounted gear; and in underground vaults. These fuses provide predictable protection with simplicity and economy. That's why they are going places.

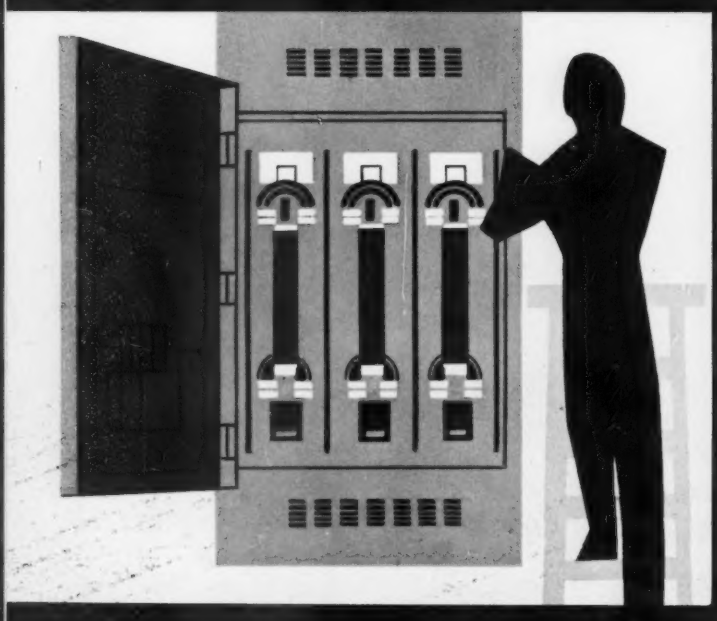
S&C

OUR GOLDEN JUBILEE

Places like these:

IN PAD MOUNTED GEAR

At sectionalizing points or connected to pad mounted transformers, S&C power fuses protect (and even switch) residential underground circuits—in air. The wide choice of fuse ratings enables the utility to uprate its underground system to accommodate future growth needs.



ON WALLS

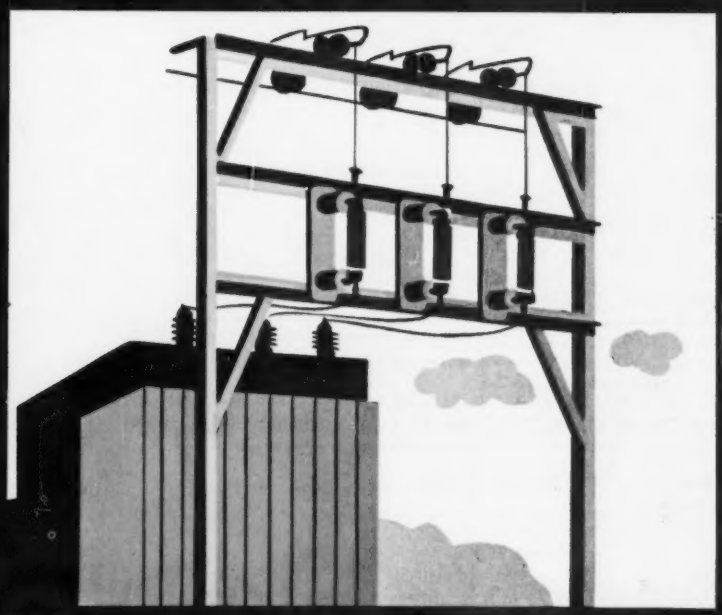
Now you can hang 500,000 kva on a wall with S&C's line of high-voltage metalclad fuses. These compact units conserve valuable floor space while providing fully adequate high-voltage fault protection on industrial and commercial power circuits.

IN VAULTS

Newest addition to S&C's metalclad fuse line is the submersible style for use in vaults or basements where flooding is a possibility. Rated at 4.8 and 14.4 kv, these units carry 200E or 400E amperes continuous, and have interrupting ratings up to 500,000 kva.

IN PLANTS AND BUILDINGS

Power fuses, combined with load interrupters and packaged as S&C Metalclad Switchgear, cut protection costs in half by replacing circuit breakers. Power fuses provide needed protection against permanent destructive faults encountered on industrial and commercial high-voltage circuits. (Load interrupters do the switching.)



IN SUBSTATIONS

The 1,000,000 kva interrupting rating (at 34.5 kv) of S&C's Type SM Power Fuse has made it first choice for protection of large power transformers in distribution substations. This means low-cost, maintenance-free protection against primary and secondary faults, without main line outages.

ON POLES

S&C power fuses can be pole-mounted for line sectionalizing, fusing distribution transformers where short-circuit currents are unusually high, and protecting distribution feeders. Low energy arc-extinguishing action reduces exhaust blast hazards to tolerable limits for linemen and the public alike.

S&C power fuses

50/60 CYCLE SHORT CIRCUIT INTERRUPTING RATINGS OF S&C TYPE SM POWER FUSES

In Amperes, Rating Is RMS Asymmetrical—In Kva, Rating Is Symmetrical 3-Phase on Basis of Asymmetry Factor 1.6

Nominal Rating, Kv		SM-4 REFILL UNIT						SM-5 REFILL UNIT					
Fuse	System	SM-4D INDOOR HOLDER (with Sneezer)		SM-4B INDOOR HOLDER (with Muffler)		SM-4 OUTDOOR HOLDER (without Sneezer or Muffler)		SM-5D INDOOR HOLDER (with Sneezer)		SM-5C INDOOR HOLDER[1] (with Muffler) Caution—See Note		SM-5 OUTDOOR HOLDER (without Sneezer or Muffler) Caution—See Note	
		Kva	Amp	Kva	Amp	Kva	Amp	Kva	Amp	Kva	Amp	Kva	Amp
4.16	2.4									150 000[2]	60 000	150 000[2]	60 000
	2.4/4.16 GrY									250 000[2]	60 000	250 000[2]	60 000
7.2 (7.5)	2.4	45 000	17 500	72 000	27 500	72 000	27 500	90 000	34 500	.....	44 500	.....	44 500
	2.4/4.16 GrY	80 000	17 500	125 000	27 500	125 000	27 500	150 000	33 500	200 000	44 500	200 000	44 500
	4.8	90 000	17 500	144 000	27 500	144 000	27 500	156 000	30 000	225 000	43 500	225 000	43 500
	7.2	115 000	15 000	195 000	25 000	195 000	25 000	195 000	25 000	325 000	41 500	325 000	41 500
14.4 (15)	7.2	115 000	15 000	195 000	25 000	195 000	25 000	195 000	25 000	300 000[2]	40 000	300 000[2]	40 000
	4.8/8.32 GrY	135 000	15 000	225 000	25 000	225 000	25 000	225 000	25 000	350 000[2]	40 000	350 000[2]	40 000
	12	195 000	15 000	260 000	20 000	260 000	20 000	300 000	23 000	500 000[2]	40 000	500 000[2]	40 000
	7.2/12.47 GrY	200 000	15 000	270 000	20 000	270 000	20 000	310 000	23 000	500 000[2]	40 000	500 000[2]	40 000
	7.62/13.2 GrY	200 000	14 000	285 000	20 000	285 000	20 000	325 000	22 500	500 000[2]	40 000	500 000[2]	40 000
	13.8	210 000	14 000	300 000	20 000	300 000	20 000	340 000	22 500	500 000[2]	40 000	500 000[2]	40 000
	14.4	220 000	14 000	310 000	20 000	310 000	20 000	350 000	22 500	500 000[2]	40 000	500 000[2]	40 000
23	7.2/12.47 GrY	.....	12 500	.....	20 000	.....	20 000	.....	20 000	.....	32 000	.....	32 000
	14.4	.....	12 500	.....	20 000	.....	20 000	.....	20 000	.....	32 000	.....	32 000
	23	250 000	10 000	375 000	15 000	375 000	15 000	435 000	17 500	750 000	32 000	750 000	32 000
34.5	23	.....	10 000	.....	15 000	.....	15 000	.....	17 500	.....	28 000	.....	28 000
	27.6	.....	8 800	.....	12 500	.....	12 500	.....	16 300	.....	28 000	.....	28 000
	34.5	280 000	7 500	375 000	10 000	375 000	10 000	560 000	15 000	1000 000	28 000	1000 000	28 000

1. Available only when furnished as an integral component of metal-clad switchgear, constructed in accordance with Data Sheet 605-1 and 605-2.

2. Nominal rating.

For additional information on S&C power fuses, contact your local S&C representative or write to:

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Printed Drawings Save Time, Labor

DEAN W. PALMER, Design Specialist, Kansas Gas & Electric Co, Wichita, Kans.

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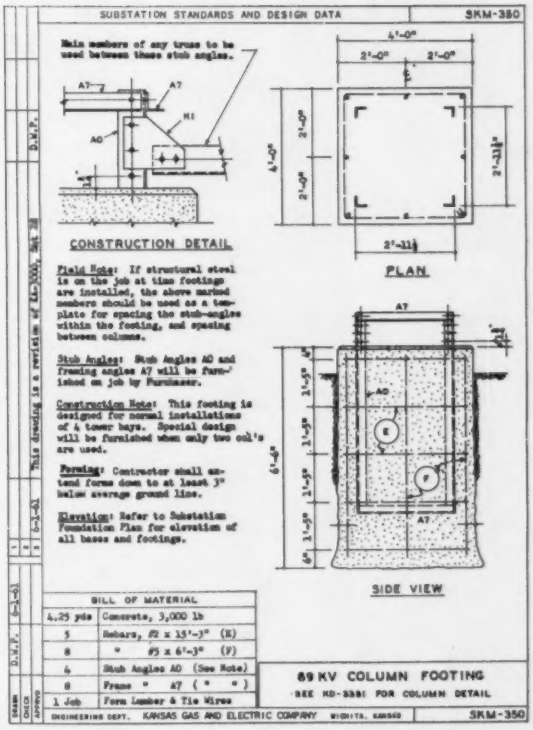
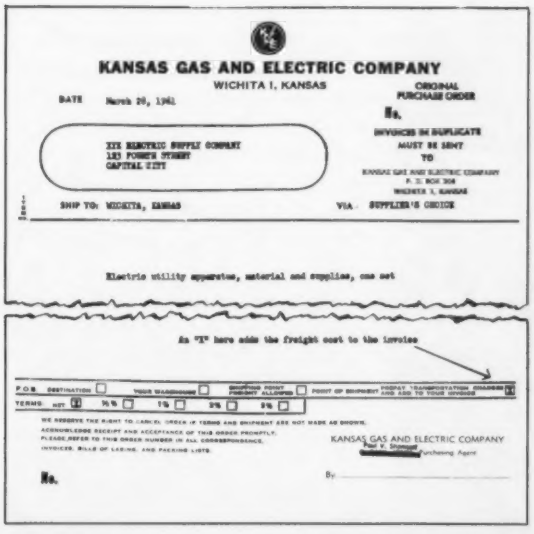
At Kansas Gas & Electric Co, printed drawings for substation design work saves much time and legwork in the making of prints of small (8½ x 11-in.) detail sheets. For those standard drawings that are apt to be issued or used periodically, prints are made in quantities of 100 at a time on a Xerox reproducer and offset printer. Prints are padded in groups of 50 to hold, conveniently and securely, individual sheets together in the file.

Standard 8½x11-in. prints from a commercial blueprint company will cost about 10¢ each in small quantities. White prints from KG&E's blue printer are charged out at 3¢ each. By using the reproducer and offset printer, the cost is further reduced to 1¢ each in quantities of 100. Furthermore, KG&E's field men welcome drawings printed in ink which do not fade with use.

The author is aware that not all companies may have reproducer and offset equipment. But any town or city which boasts a commercial blueprinter almost surely has a commercial printer who can make Xerox masters and run them on an offset machine.


SUBSTATION STANDARDS AND DESIGN DATA
SKM-350
CONSTRUCTION DETAIL
PLAN
SIDE VIEW
BILL OF MATERIAL
4.25 yds Concrete, 3,000 lb
5 Rebars, #2 x 15'-3" (E)
8 " #5 x 6'-3" (F)
4 Stub Angles AO (See Note)
8 Frame " A7 (" ")
1 Job Form Lumber & Tie Wires
69 KV COLUMN FOOTING
SEE KD-3381 FOR COLUMN DETAIL
ENGINEERING DEPT. KANSAS GAS AND ELECTRIC COMPANY WICHITA, KANSAS
SKM-350

INK PRINTS are padded in groups of 50 for convenience



ARROW noted on above form indicates placement of 'X' to say that vendor should prepay freight, add to invoice

Prepaid Charges Save Time, Money

By asking suppliers who sell and ship material to the company to prepay shipping charges and add the freight cost to the invoice, Kansas Gas & Electric Co is saving time and money.

Paul V. Shannon, KG&E purchasing agent, reports the plan eliminates duplication, cross-matching of bills, saves time in the accounting department and "often eliminates issuing a second check to pay freight costs."

The practice started with the adoption of a new purchase order form with a multiple-choice list of shipping and billing information across the bottom. With the new form, a typist marks with an "X" the instructions the shipper will need.

In the past, information was typed on the form itself, as indicated opposite arrow in illustration.

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Now Westinghouse UNOREG* can handle 81% of all voltage re-regulation on secondary distribution systems—at savings up to 60%. The introduction of a new 2½ KVA UNOREG extends the benefits of this lowest cost regulating system to cover a total of 8 standard ratings in over 600 transformer styles.

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UNOREG works on an induction principle with two sets of coils: a rotor and a stator. A solid state control meters the input voltage, actuates the rotor which raises or lowers the output voltage automatically. Its operation is maintenance-free and completely reliable. Contact your Westinghouse sales engineer to learn how other electric utilities are reducing operating costs with UNOREG. Or, write: Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. *You can be sure . . . if it's Westinghouse.*

The 1¼ KVA UNOREG is available to handle transformer ratings up to 25 KVA and the 2½ KVA model handles ratings up to 50 KVA. Color-coded for easy connection. Tank-mounting bracket has standard 12" bolt hole spacing for pole mounting.

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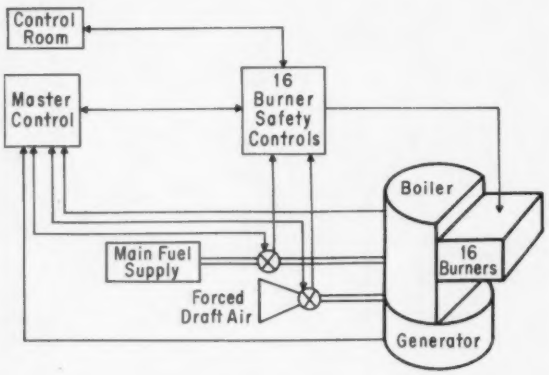
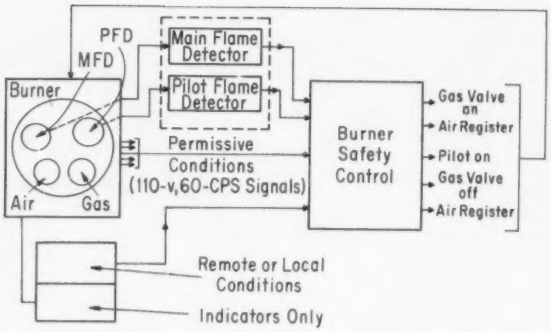
J-70978

Westinghouse





Develops Transistorized Burner Control

D. R. WHITSON, Head, Industrial Products Branch, Apparatus Division, Texas Instruments Inc, Dallas, Tex.

Transistorized circuitry has been designed and developed as a replacement for original relay circuitry for the logic portion of safety control and master control subassemblies for remote firing of burners in power plants. The transistorized circuitry, developed in cooperation with Forney Engineering Co, Dallas, Tex., for its burner control system, has been installed by a Southwestern electric utility.

The transistorized burner safety control system makes the necessary decisions during startup, operation and shutdown according to preprogrammed logic (left figure). Each burner in the system has a separate safety control which responds to command signals from the control room and master control. Signals from the boiler, generator, main fuel supply, forced-draft air supply and other plant equipment are monitored by the master control. Any discrepancy in system parameters is detected by the master control, which causes the safety control to give appropriate commands to individual burners.

Lightoff is accomplished by a command signal to the burner safety control over a basic burner subloop (right figure). The control checks all of its transducer inputs for proper conditions before igniting the pilot. Following pilot ignition, the control causes other operations to be performed in a timed sequence. Any delay or incorrect condition in this sequence will result in a shutdown. The pilot is extinguished 25 sec after main-flame lightoff is detected.

Using a flame-sensing device developed by Forney Engineering, the burner safety control continuously monitors its associated burner for proper lightoff and operation. In the event of any malfunction, the control shuts down the burner in sequenced steps. A normal shutdown is similarly programmed for operation upon command.

In developing the transistorized circuits, major consideration was given to flexibility in basic digital logic to meet variations in types of boilers, burners, fuel and operating procedures. Operation over a temperature range of —20F to 180F, negligible unscheduled down time over at least a 20-year period, and maintenance and testing on a level consistent with skills of operating personnel were design requirements. In addition, transducer inputs had to be flexible in number, with 14 required for the simpler installations. Each input is a 115-v, 60-cps signal.

To meet these basic requirements, the transistor-resistor logic circuit was selected as the basic unit with silicon NPN transistors of the industrial switching type. Primary and emergency power sources for the burner control are 115-v, 60-cps, single-phase supplies. Selected supply voltages of +20 and —20 v dc are regulated ±2% over the operating temperature range for input voltages of 95 to 145 v ac.

Resistor values were selected to meet conditions given by ON and OFF equations based on four inputs and outputs each. To meet aging and variation requirements, 1% tolerance was specified. The rating of 0.5 w was specified for all resistors, as additional savings in volume did not warrant the increased cost of smaller-wattage resistors.

For maximum logic flexibility, which permits additional inputs or outputs to be added to a stage, only one transistor type is used in all circuits. The type selected has the necessary gain and power handling capabilities to meet switching-rate requirements, which for this application are never faster than 20μ sec and generally are much slower. To assure reliable operation at temperature extremes, the leakage current at the highest temperature, 180F, does not exceed 20 μamp; the gain at the lowest temperature, —20F, is not less than 50. Similar considerations were given to the selection of the silicon-controlled rectifiers used in the power output stages.

BLACKBURN PAC CLAMPS

In salt-laden coastal atmospheres, in fume-choked industrial areas . . . millions of Blackburn PAC clamps stay on the job year after year. No breakdown. No deterioration of electrical efficiency.

We've treated them even worse in our laboratory. Over 10 years of torturing salt spray and heat cycle tests, and they still perform like troupers. The PAC Series is the most corrosion resistant, electrically efficient BIMETALLIC connector in the world! The reason? Some exceptionally fine engineering and construction that eliminates soldered liners.

We'd like to show you how these extraordinary clamps are made and how they reacted to our severe testing. Write for Data Folder #6007.

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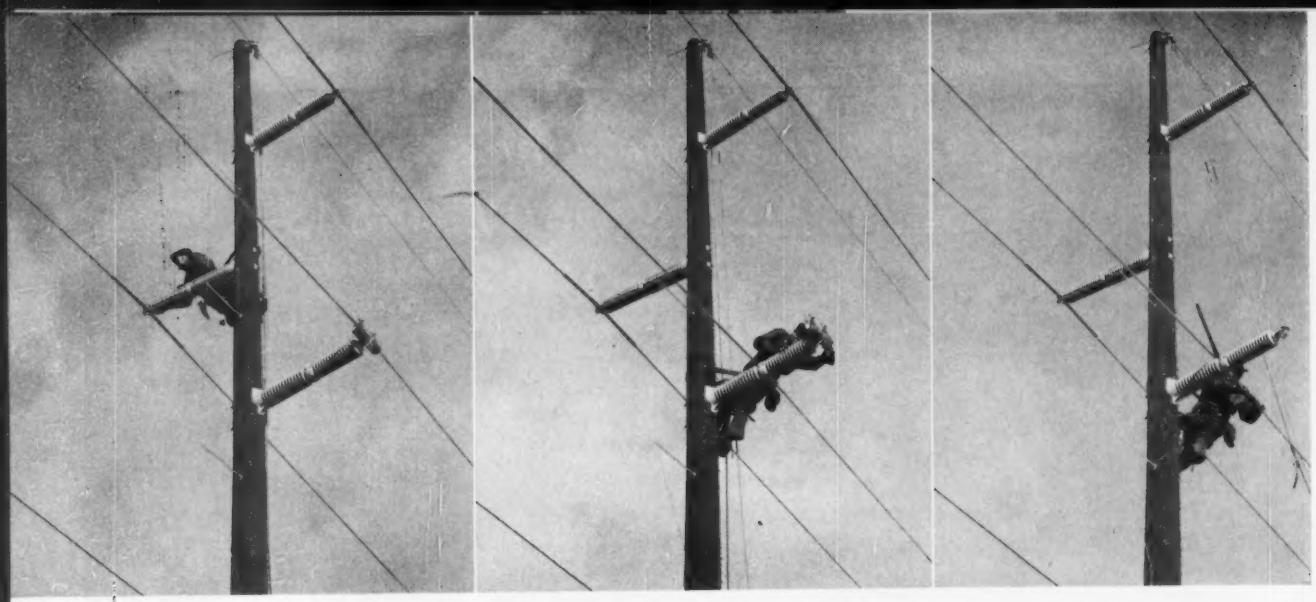
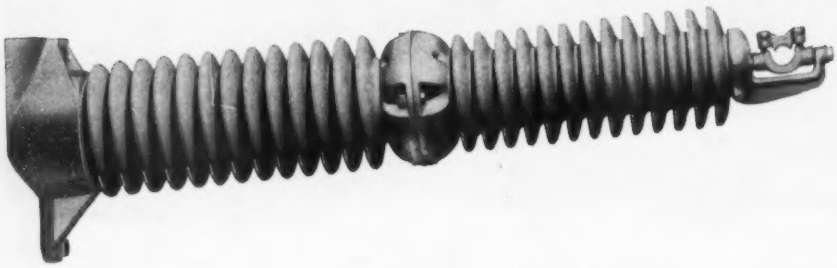
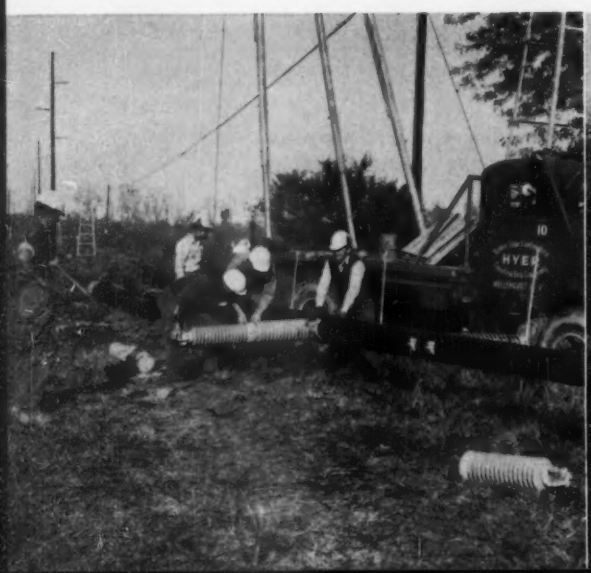
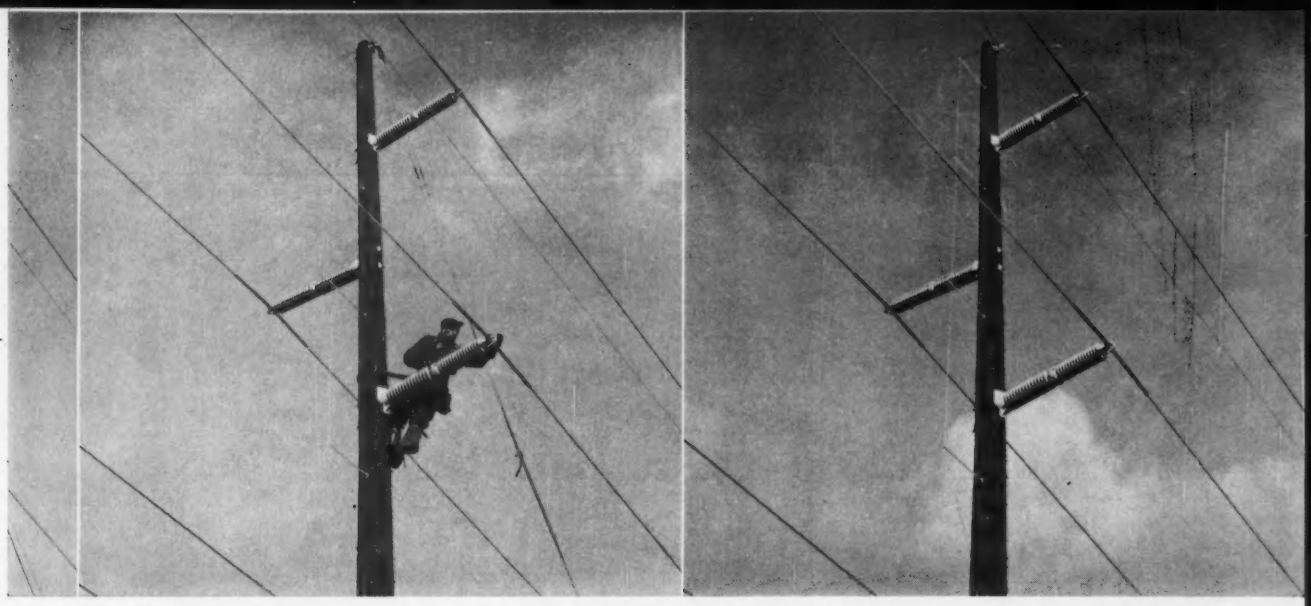


and now HORIZONTALLY-



armless construction requires narrowest right-of-way.....unobtrusive





MOUNTED LAPP LINE POSTS FOR 115-138 kv TRANSMISSION

Armless construction using horizontally-mounted Lapp Line Posts is now a standard practice with many utility companies for transmission and sub-transmission lines at voltages up through 69 kv.

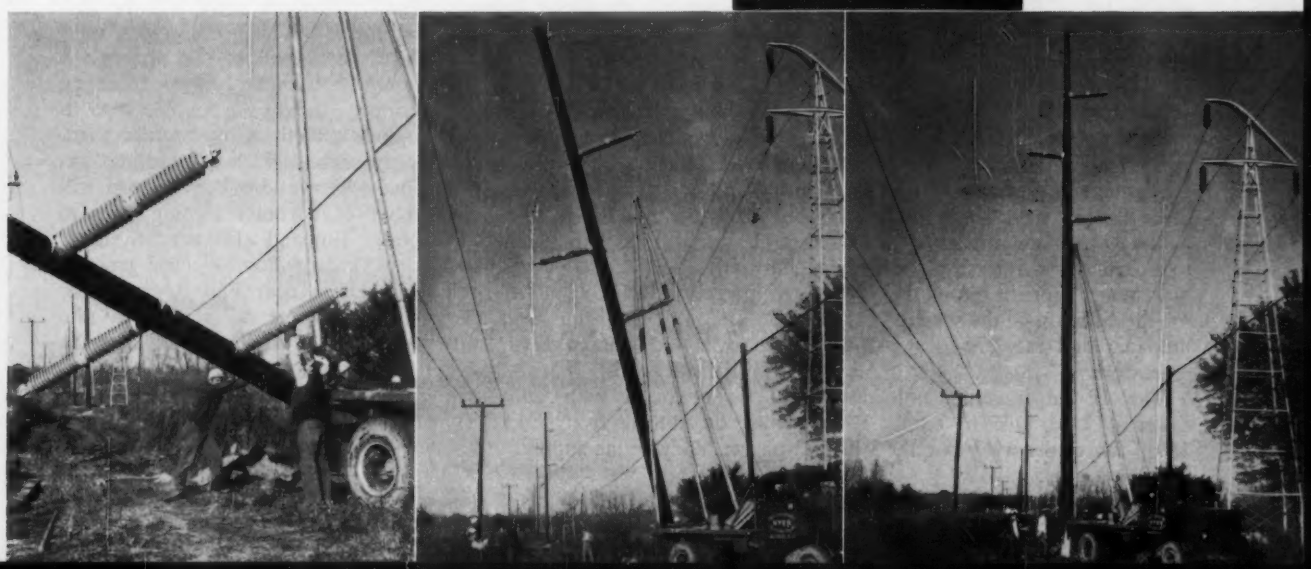
Now the same advantages of such armless construction are available for transmission at 115 kv and 138 kv. The externally-attached integral gain base is a malleable iron casting which provides maximum contact to pole. Insulator is bolted directly to the pole by bolts at top and bottom of the base. The structure is easily assembled on the ground before erection, as shown in the picture sequence below. Clamp-top head with trunnion clamp makes for easy one-man assembly to conductor.

Units of two strength classes are available, each in three lengths, which match (and, in some important characteristics, exceed) flashover values for strings of 6, 7, and 8 suspension insulators.

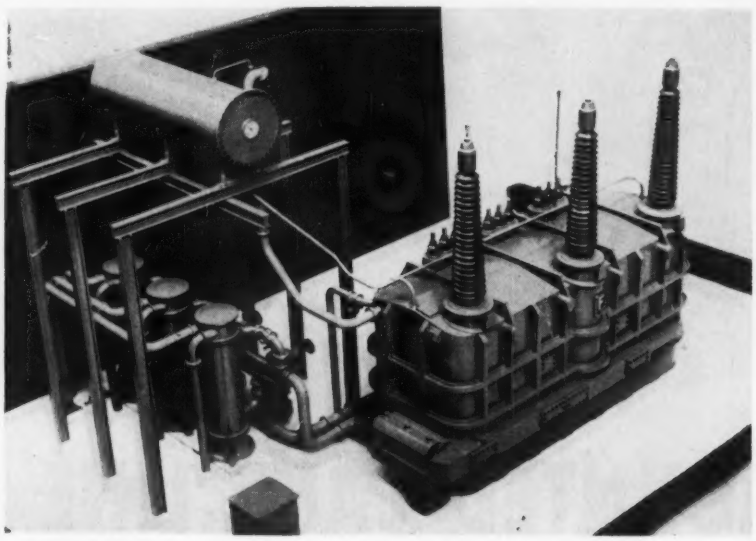
Write for complete data. Lapp Insulator Co., Inc., Le Roy, N. Y.

"low voltage look" for use in built-up areas

Lapp



Extra-Large Transformers Ordered



SCALE MODEL depicts installation arrangement of one of four 570-Mva 3-phase, 22/430 kv, delta—wye connected double-wound generator transformers

It was recently reported that the largest generator transformers in the world will be manufactured by Ferranti Ltd, as ordered by England's Central Electricity Generating Board. The order calls for four 570-Mva, 3-phase, 22/430-kv, delta—wye connected, 50-cps, double-wound generator transformers.

The transformers, to be installed at the West Burton, 2,000-Mw coal-fired generating station, will contain Ferranti high-speed resistor transition on-load tap-changing gear which will provide for voltage variations of plus or minus 10%, in 18 steps. Cooling will be achieved by forced-oil circulation through oil/water heat exchangers.

The design of the transformers' cores will reportedly insure minimum core loss. The weight of each complete transformer, stripped for transport, will be kept down to 215 tons, and dimensions will be 32½ x 13½ ft, height—16 ft 2 in.

This new order follows those received by Ferranti from the Central Electricity Generating Board for 310 and 400-Mva generator transformers.

Coal Unloader Handles 800 Ton Per Hr

Expanded facilities at the Will County Generating Station of Commonwealth Edison Co, Chicago, Ill., will be served by a 12-ton traveling coal unloading tower now being designed by Dravo Corp, of Pittsburgh.

The power plant is being expanded by the addition of a fourth generating unit that will increase the plant's net generating capability from its present 585 Mw to 1,095 Mw. Increased coal requirements brought about the need for the addition of the second barge unloader and the 700-ft-long dock extension.

The 12-ton traveling unloading tower will be able to empty two 1,200-ton coal barges in only 3 hr. With a 480-cu-ft bucket and operating on a digging cycle of 35 sec from barge to discharge hopper, the rope-operated Dravo unloader will have a free-digging rate of 1,235 net tons per hr.

The bucket trolley will rack back and forth at 480 ft per min on a boom 85 ft above normal water level, and bucket hoisting speed will be 285 ft per min. The unloader's cantilevers will be long enough to permit the bucket trolley to work over barges as far as 73 ft from the dock side rail and the same distance over the storage yard from the yard side rail. The unloader will be operated with adjustable voltage dc controls from a 4,160-v, 3-phase, 60-cycle, ac supply.

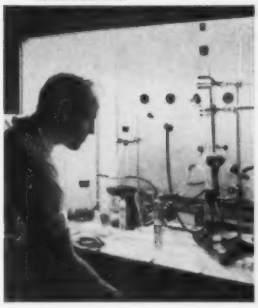
Rails on which the tower will travel at 80 ft per min will be 30 ft apart. Between them will be two parallel 54-in. belt conveyors, onto which coal will be fed through a double-bottomed, 100-ton receiving hopper. It will be possible also to unload directly to the storage yard.

A second 12-ton traveling unloading tower by Dravo Corp will move coal from sea-going ships to New England Electric System's new Brayton Point electric generating station near Fall River, Mass. It will operate at speeds and rate of discharge similar to those of the installation at Will County Generating Station.

(*More News of Manufacturers, p* 67)

Electron Microscope magnifies particles of battery raw material 16,000 times, increases understanding of physical properties—gives improved Gould battery performance.

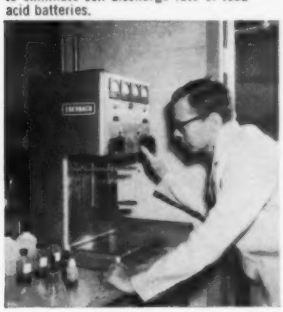
Analyzing nature of impurities in battery material—one of many special projects carried on by Gould-National technicians to increase the life of Gould batteries.



Gould-National Battery Research Center in Minneapolis, Minn., and quality control facilities at Kankakee, Ill., and Trenton, N.J. assure you that only the highest quality is built into Gould batteries.

Tensile Test Unit studies tensile and compressive strengths and percentage of elongation of various materials—used to develop stronger containers for Gould batteries.

Quantitative Analysis Unit determines percentage of element concentration in metal samples. Currently used in study to eliminate self-discharge rate of lead-acid batteries.



BATTERY RESEARCH . . . 24 HOUR JOB AT GOULD-NATIONAL

At the Gould-National Battery Research Center around-the-clock testing produces a continuous stream of new ideas. Here, creative research minds and the latest scientific equipment combine to assure you of batteries designed and engineered to meet today's most exacting requirements . . . and to anticipate the answers for tomorrow's standby power needs. Gould stationary batteries are available in Plante, Calcium and Kathanode types. Complete stocks and service facilities are located across the country.

CHARGERS—A full line of specially engineered stationary charging equipment available: float, filtered and unfiltered. Ask about the new FLOAT-O-MATIC charger.

Write for detailed information, or call your local Gould office listed in the Yellow Pages under "Batteries, Industrial." Sales offices and agents in continental United States and overseas.

NEW Gould Rechargeable Flashlight and Lantern Batteries

Of nickel-cadmium construction, these batteries can be recharged to full capacity over 250 times . . . and each cycle gives 50% more continuous, bright light than ordinary cells. Ask for free literature.

More Power to you from GOULD

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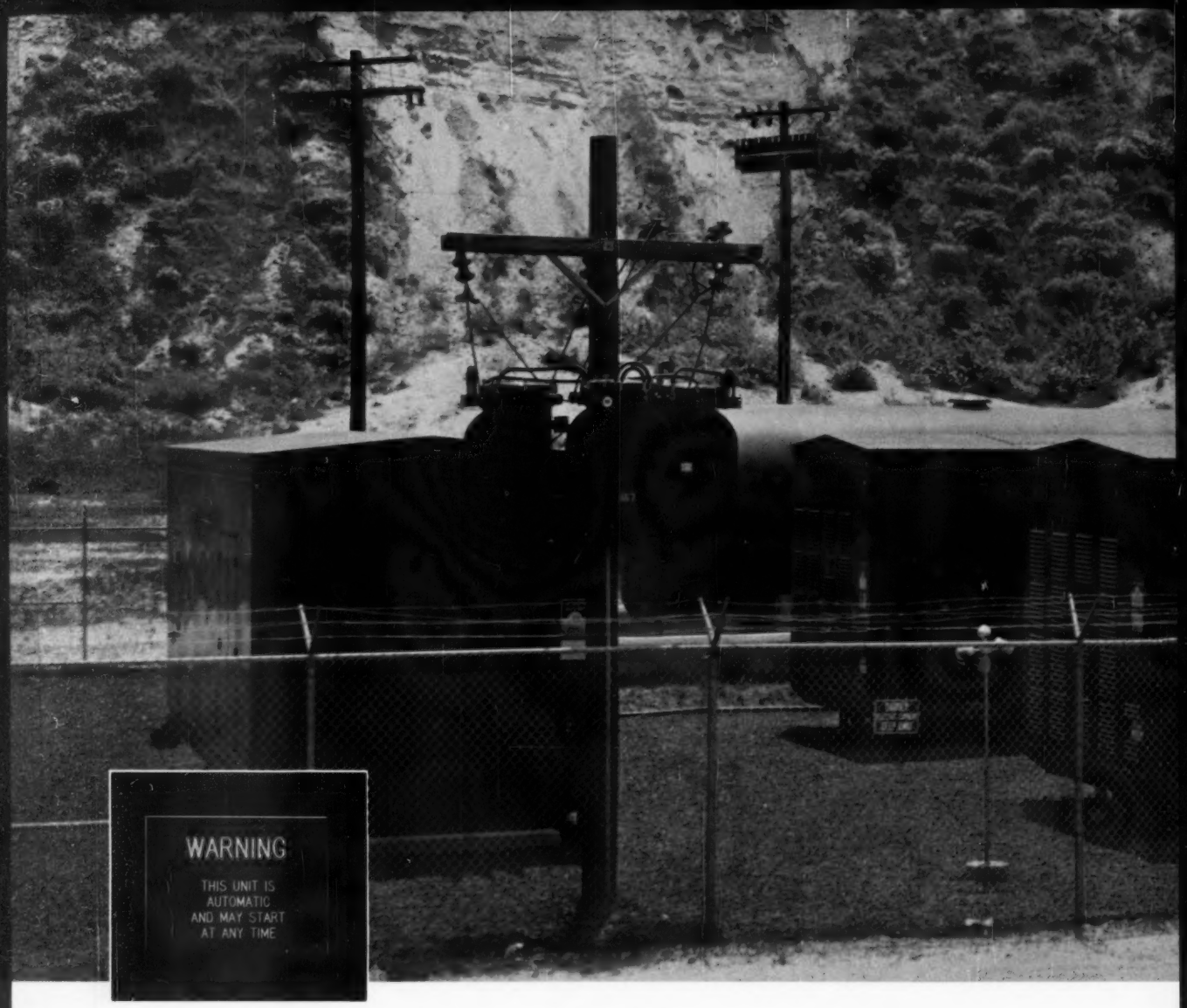
St. Paul 1, Minnesota



Long Island Lighting picks Diesel Peaking

Long Island Lighting Company has installed a 4000 KW Electro-Motive Peaking Plant at Northport, Long Island to provide area protection and spot peaking by remote control.

The Plant is designed to also supply construction power and emergency starting power for a large steam plant now being built.

WARNING—THIS UNIT IS AUTOMATIC: This sign, which is attached to the Electro-Motive Plant, points up an important operating feature. In the event that a line outage occurs at any time, and attempts to reclose fail, an automatic signal starts the Electro-Motive Plant. It comes up to full speed, synchronizes and loads in less than two minutes to provide emergency area protection. When service is restored, the Electro-Motive Plant automatically shuts down.

PEAKING SERVICE: In addition to providing emergency protection for the area, the Electro-Motive Plant will function as a spot peaking power generator. For this service it will be operated by remote control from the Hicksville Operations Center. And the quiet smoke-free operation of the Diesel Plant makes it ideal for its suburban location.

ADAPTABLE TO MANY FUNCTIONS—The inherent design characteristics of the Electro-Motive equipment on the Long Island Lighting

Plants for economical area protection

system that make it ideal for peaking and area protection, also make it well suited for many of your system requirements:

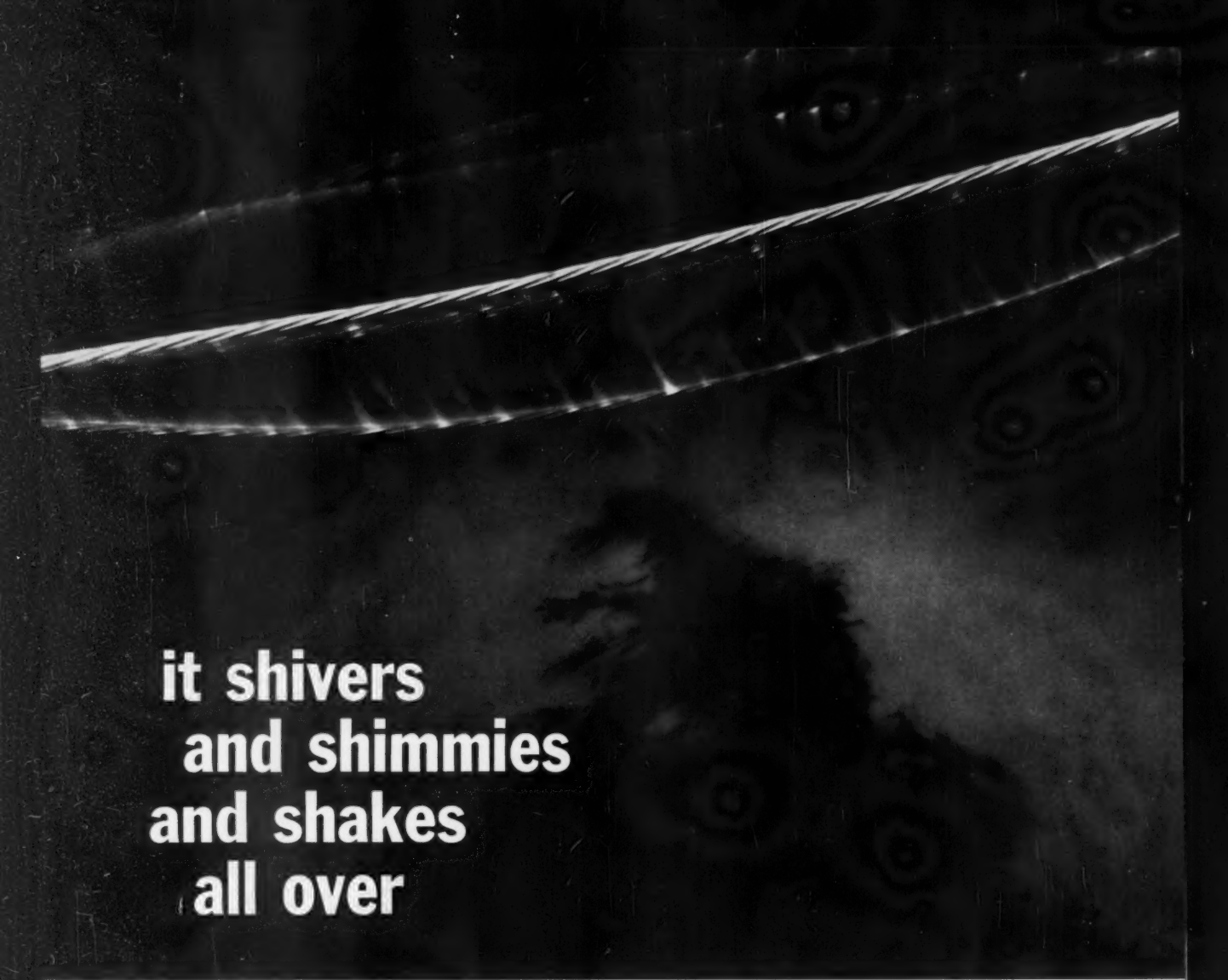
- fast start for spinning reserve
- automatic dead load pick-up for area protection
- unattended operation for remote peaking service
- freedom from damage to components caused by rapid thermal changes occurring from start to full load.

Available in units from 2000 KW to 10,000 KW, the Electro-Motive peaking equipment line contains both Diesel and dual-fuel plants that permit matching the plant to exact requirements for the most economical and efficient operation at the lowest investment. Ask your Electro-Motive representative for details.

ELECTRO-MOTIVE DIVISION · GENERAL MOTORS

LA GRANGE, ILLINOIS

In Canada: General Motors Diesel Limited, London, Ontario



But your vibration problems are minimized if it's bethanized strand

Steel

for Strength
. . . Economy
. . . Versatility

Overhead ground wires vibrate every time the wind blows. And that vibration is destructive, because it sets up fatigue stresses which can ultimately cause weakening and failure. But Bethlehem bethanized strand has superior resistance to fatigue. Here's why.

BETHANIZING FOILS VIBRATION

Fatigue tests show the superiority of bethanized wire over other types of coated wire, including conventional galvanized wire. First, because steel wire, with its high endurance limit, is best able to withstand fatigue stresses. Secondly, the smooth uniform coating of pure zinc, electrolytically applied in the bethanizing process, in most cases actually enhances this endurance limit.

BETHANIZING FOILS CORROSION, TOO

The bethanized coating is exceptionally ductile because the zinc is so pure. It does not peel or crack, provides excellent corrosion-resistance. Available in four different coating weights, it gives you the right corrosion protection for each installation. For full information, get in touch with the nearest Bethlehem sales office.

Bethlehem Steel Company, Bethlehem, Pa. *Export Sales:* Bethlehem Steel Export Corporation
Distributor: Joslyn Mfg. & Supply Co.

BETHLEHEM STEEL

BETHLEHEM STEEL

Single Stage Pump/Turbine Will Pump to 1200 Ft

English Electric Co will supply two extra-high-head, single-stage reversible pump/turbines to the North of Scotland Hydro-Electric Board for installation at their new 440-Mw pump storage power plant at Cruachan in Argyllshire. The pump/turbines, rated at 142,000/136,500 hp, will pump water at night from an underground plant at Loch Awe to a reservoir 1,200 ft above, in readiness for daytime peak load requirements.

The pump/turbines were jointly developed by English Electric and Sulzer Bros of Switzerland to meet the Board's specifications. These two firms also worked together on equipment for Central Electricity Generating Board's Ffestiniog plant in North Wales where four 105,000-hp single-runner separate turbines and pumps are being installed.

Core Drum Memory Mated To Up Computer Capability

A medium-scale computer system with both core and drum memory has been announced by Sperry Rand Corp. The integration of core with drum memory is said to make this computer the fastest, most powerful medium-scale system available today, with twice the work-load capacity of similar computers.

Total memory capacity of the Univac Solid State II Computer, as it is called, is expandable to 110,880 digits; the core has 14,080 digits; the drum can have from 28,600 to 96,800 digits. Information stored in core memory can be accessed at the rate of 1.5 microsec per digit. Data can also be moved from drum and core storage in the same access time per digit, up to 2,200 digits in a single operation. Two tape synchronizers and up to 20 tape servos enable simultaneous read-write, read-read, and write-write operations.

Adaptable to punch-card processing, the system will accommodate 80 or 90-column cards, and plastic or metallic magnetic tape. It can read at 600 cards per min, punch at 150 cards per min, and print at 600 lines per min—all operations being carried on simultaneously.

Manufacturers Literature

Electrical Standards

EEI/NEMA STANDARDS . . . on automatic temperature controls (nameplate information, ampere ratings, voltage rating and load characteristics), Pub No. DC 6-1961, six pages 25¢; on electric comfort heating equipment, Pub No. HE 2-1961, 10 pages, 35¢; on industrial heating units and devices, Pub No. HU 1-1961, 16 pages, 35¢; American Standard test methods for electric power insulators, Pub No. HV 10-1961, 16 pages; EEI-NEMA standards for distribution transformers, overhead type—seventh report, Pub No. TR 2-1960 (EEI Pub No. 60-54), 30 pages, $1.25; nonreturnable reels for wires and cables, Pub No. WC 21-1961, seven pages, 30¢; EEI-NEMA standards for mounting brackets for distribution cutouts and distribution-class lightning arresters, Pub No. 100-1960, (EEI Pub No. TDJ-19), eight pages, 30¢.
Also, specifications on copper magnet wire—round, single and heavy polyurethane-coated, used in the manufacture of electrical apparatus. Product covered by this standard is designed and manufactured to coordinate with performance requirements of the American Institute of Electrical Engineers for 105 C (Class A) insulating material. Pub No. MW 2, 16 pages. National Electrical Manufacturers Assn, 155 E 44 St, NYC 17.

ASTM/ASA STANDARDS . . . methods of testing rubber and thermoplastic insulated wire and cable (ASTM D470-59T), Pub No. C8.22-1960, 50¢; specification for natural rubber sheath for wire and cable (ASTM D532-58), Pub No. C8.25-1960, 30¢; specification for styrene-butadiene (SBR) synthetic rubber sheath for wire and cable (ASTM D866-58), Pub No. C8.28-1960, 30¢; specification for ozone-resisting insulation for wire and cable (ASTM D574-59T), Pub No. C8.29-1960, 30¢; test methods for electrical power insulators, Pub No. C29.1-1961, $1.50. Also, schedules of preferred ratings for power circuit breakers, sixth revision since 1945; data supplied by American Institute of Electrical Engineers, National Electrical Manufacturers Association and Association of Edison Illuminating Cos used as basis. Standards cover both indoor and outdoor power circuit breakers—and both oil and oilless in each category. Pub No. C37.6-1961, 80¢. American Standards Association, Inc, 10 E 40 St, NYC 16.

PENGO AUGERS

Save you money 4 ways

PENGO HEAVY-DUTY Twin Helix Augers—14" through 96" hole diam.

1 **BORE FASTER**...put real "teeth" in earth drilling, save wear and tear on your diggers.

2 **STAY ON THE JOB LONGER** ...all wearing parts replaceable in the field; no down-time for shop welding.

3 **COST FAR LESS TO MAINTAIN** ...reversible teeth cost only 90¢ each, pilot bit only $8.00. Parts interchangeable on all PENGO augers you are using...less inventory!

4 **A SIZE AND TYPE FOR EVERY BORING JOB**...Augers and boring heads (for welding to your present auger) available for every make of machine from post hole diggers to largest heavy-duty earth drills. Write for catalog.

PENGO Prope®

—the most satisfactory construction rope available today!

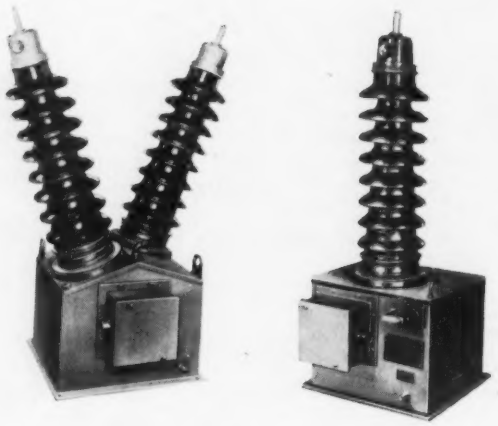
* GREAT STRENGTH
(8,200 lbs. for ¾" diameter)
* LIGHT WEIGHT
(11 lbs. per 100 ft. ¾" diameter)
* HANDLES AND SPLICES LIKE MANILA
in any climate or weather
* WATERPROOF
(even salt water); can't mildew or rot. Excellent dielectric properties.

PENGO-Prope is a synthetic rope of special construction available in all popular diameters from 3/16" to 2"; regular construction in sizes smaller than 3/16". Write for specifications, prices.

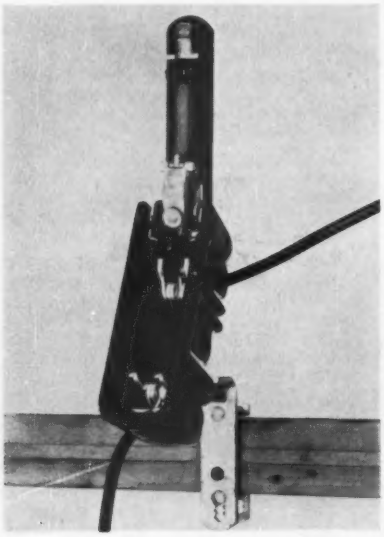
PETERSEN
ENGINEERING COMPANY, INC.
Santa Clara, California
Axminster 6-7712

New Equipment

Potential Transformers . . .



. . . oil-filled, outdoor, reportedly are the smallest and lightest of their kind, averaging 10% smaller and 20% lighter than previously available units. Type APT transformers are suitable for metering or relaying applications. Rated 25 through 69 kv, 150 through 350-kv BIL, they are offered in single and two-bushing design. For compactness, the "solid insulation" principle, which eliminates need for oil ducts, is used (first introduced in potential transformers of 115 kv and above). Thus, a 69-kv single-bushing unit is reduced from 675 lb and height of 61 in. to 570 lb and height of 57 in. Similar weight and height reductions are achieved in the 25, 34.5 and 46-kv designs. **Westinghouse Electric Corp, Box 2099, Pittsburgh, Pa.**

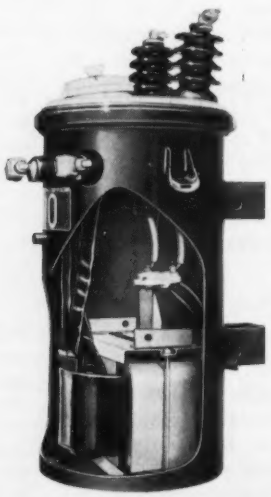


Enclosed Cutout . . .

. . . incorporates interchangeable doors for quickly uprating interrupting capacity or continuous ampere ratings. Each of two porcelain housings (for voltage ratings of 2.6/5.2 kv and 7.8 kv) accepts four interchangeable door assemblies. Door assemblies are available in 50 and 100-amp continuous ratings and NEMA interrupting capacities up to 8,000 amp at 7.8 kv, 10,000 amp at 5.2 kv and 14,000 amp at 2.6 kv. Doors can be easily inserted or removed with a standard hookstick; insertion of a single screw converts the cutout from indicating to non-indicating. Contacts are relieved of recoil stress, which is said to assure high-pressure, low-resistance contact during interruption. This is achieved by improved, lower trunnion construction which permits the entire fuse tube thrust to be absorbed by the trunnion and transmitted to the box and a heavy-duty hangar, rather than to the contacts. A spring flipper whips fuse cable out of the cartridge, aids low fault interruption; re-fusing is reportedly simple and fool-proof.
James R. Kearney Corp, 4236 Clayton Ave, St. Louis 10, Mo.

Distribution Transformer . . .

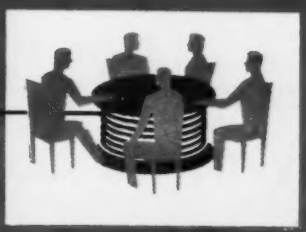
. . . features a core with progressive step-type joint and rectangular configuration, which is said to provide stress-free "toroid" performance. The DS-50 transformer marks a departure from the company's former designs by using aluminum-strip conductors the full width of the coil in low-voltage windings. Optimum magnetic balance between the two windings is obtained, enabling units to withstand short-circuit currents of more than 50 times rated current. Aluminum strip windings are also said to reduce weight and hottest-spot gradients, offer better regulation and longer insulation life. The new core concept reportedly provides better regulation and contributes to over-all weight and size reduction. Units are 10, 15, 25, 37½ and 50 kv. **Delta-Star Electric Division, H. K. Porter Co, Lynchburg, Va.**



(More New Equipment on page 72)

DU PONT

WIRE AND CABLE ROUND TABLE



You have asked . . .

Question: I am well aware of the advantages of ZYTEL® nylon resin as a jacket over a primary insulation. Can I use it alone as an insulation?

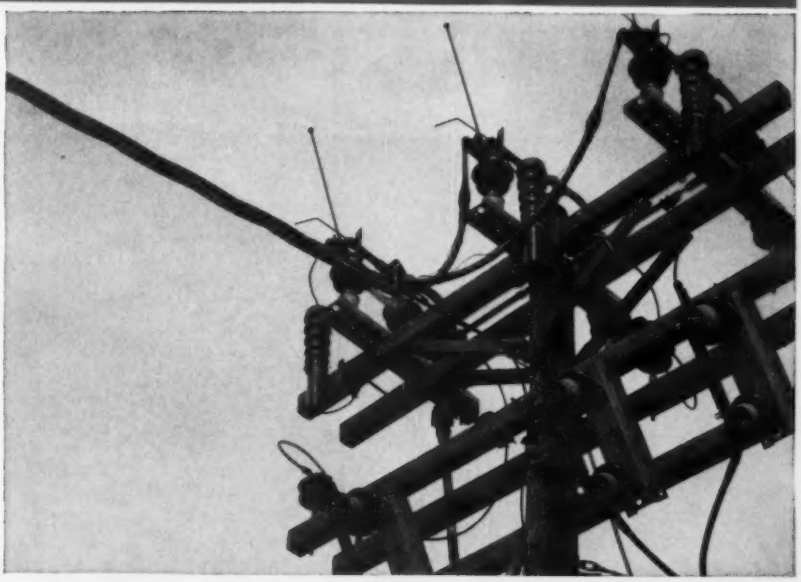
Answer: There are several constructions on which ZYTEL is used as primary insulation. Geophysical cable and blasting cap leg wire are two good examples. ZYTEL does not have the excellent electrical properties of ALATHON polyethylene resin, but can often be used to advantage where you want an exceptionally tough insulation for low voltage wiring.

Question: What about the problem of flammability with polyethylene insulation?

Answer: Polyethylene is no more flammable than many of the other materials which are in wide use today (such as paper-oil or rubber insulation). Actually we have had electric arcs in contact with polyethylene power cable insulation and jacket that melted the conductor without causing the polyethylene to propagate the flame. Where you are worried about vertical runs of thin wires, say control cable, try RULAN®.

In a recent plant fire, no damage was found in power cables located in trays directly above a severe 45 minute solvent fire. The cables were insulated and jacketed with ALATHON, in interlocked aluminum armor.

Du Pont does not manufacture wire and cable, but supplies thermoplastic resins to the wire and cable industry.



Fitchburg G & E selects Du Pont ALATHON® for 15 KV pre-assembled aerial cable

Back in 1957, Fitchburg Gas & Electric Light Company had to terminate some polyethylene insulated and jacketed cable from an industrial customer onto their power lines. This was their first exposure to polyethylene. Now Fitchburg G & E is a steady user of aerial cable protected with polyethylene.

Typical of their installations is the 15 KV three conductor pre-assembled aerial cable shown above. Designed and sold by Anaconda Wire and Cable Co., New York, this cable takes full advantage of the insulating and jacketing properties of Du Pont ALATHON polyethylene resins.

For example, ALATHON 3B, was especially designed to give the utmost corona resistance for high voltage polyethylene insulation, especially at critical bend areas. Its extremely low power factor (0.0002) and dielectric constant (2.28) do not change with temperature or time. It also offers high dielectric strength and absorbs virtually no moisture.

As a jacketing material, high molecular weight black ALATHON offers the combination of abrasion, chemical and weather resistance needed for aerial cable. Extremes in temperature, common in the Fitchburg, Mass., area, have no effect on the jacket. And it offers outstanding resistance to mechanical and electrical stress.

It will pay you to find out more about the economy and performance reliability offered by cable protected with ALATHON. Consult your wire and cable supplier, or write to: Du Pont Company, Dept. EW-925, Room 2507A, Nemours Bldg., Wilmington 98, Del. *In Canada:* Du Pont of Canada Ltd., P.O. Box 660, Montreal, Que.

POLYCHEMICALS DEPARTMENT

DU PONT
REG. U.S. PAT. OFF.

Better Things for Better Living . through Chemistry

ALATHON® POLYETHYLENE RESINS | **RULAN®** FLAME-RETARDANT PLASTICS | **ZYTEL®** NYLON RESINS

If it's your responsibility...

to evaluate distribution transformer performance, then it's important you consider Moloney!

...Why Moloney?

Because Moloney's concept of "Total Design" assures the best all-around efficiency per invested dollar!

When you evaluate transformers, the overall design concept is an important consideration. Through the years, Moloney has constantly improved the overall performance and quality of its transformers This progress is a reflection of the "Total Design" concept which coordinates design of all transformer components so that no feature is stressed at the expense of another.

When evaluating distribution transformers, keep "Total Design" in mind. You'll see what we mean when you compare all aspects of a Moloney Transformer with the features of competitive units.

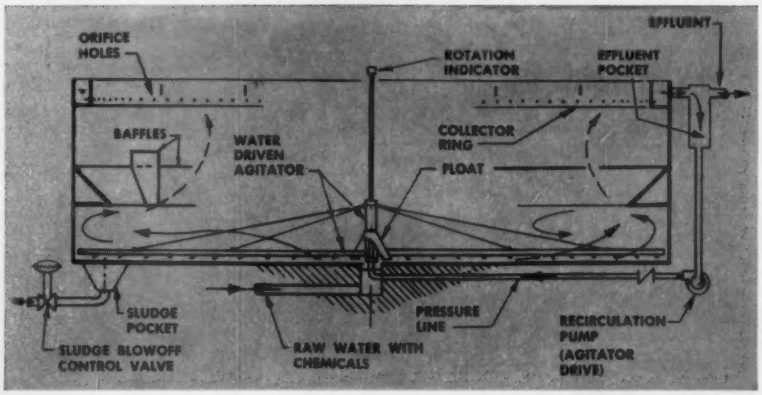
ME61-20

MOLONEY ELECTRIC COMPANY

Manufacturers of Transformers and Switchgear for Utilities, Industry, and Electronic Applications

FLUIDICS SPOKEN HERE

Water treatment news



NEW TYPE M PRECIPITATOR

...a study in simplicity

by D. Miller, Technical Manager, Permutit

Now in operation is this new precipitator for reducing turbidity and color in water.

We call it the Permutit Type M Precipitator. It is a study in simplicity, and because of its low construction and operating costs, it opens up new opportunities to obtain solids-contact clarification at minimum cost.

"Missing" parts: There is no motor-driven agitator on the Permutit Type M Precipitator. No extensive baffling. No center platform. No access walkway. All these have been done away with, because the unit has a new and different agitator system which sweeps away the settled sludge. Rotating agitator arms are supported by a "semi-buoyant" hub (or float) which revolves about a bearing post on the tank floor. Recycled effluent drives the agitator through jet nozzles located at the end of each arm. Smaller jets, spaced along the arms, gently nudge the settled sludge toward a sump at the outer rim of the tank floor.

Briefly, this is how the M unit works: raw water and chemicals are mixed in line and enter at the center of the tank floor beneath the conical rotor float which deflects the fluid mixture radially outward to the walls. A horizontal baffle on the tank wall then reverses the flow back toward the center thus imparting a rolling action to the sludge blanket. This current flow constantly places previously formed sludge in intimate mixture with the raw water immediately as it enters the tank. Clarified, effluent is collected by a flume at the top.

Sudden water changes: An additional benefit of the Permutit Type M Precipitator is its exceptional ability to handle shock loads.

A case in point: red dye from a paper mill a mile upstream showed up one day in the raw water entering a Permutit Type M Precipitator in use in New England. But the unit went right on putting out an effluent with no significant change in quality.

So much interest has been shown in this new unit that we have reprinted the paper, "A Recent Development in Solids Contact Clarification Design", by E. D. Driscoll of Permutit. We'll be glad to send you a copy.

Write to Permutit Division, Dept. EW-91, 50 West 44th St., New York 36, New York. (In Canada, contact the Permutit Company of Canada, Toronto.)

PFAUDLER PERMUTIT INC.

Specialists in FLUIDICS...the science of fluid processes

Impact-Wrench Bits . . .

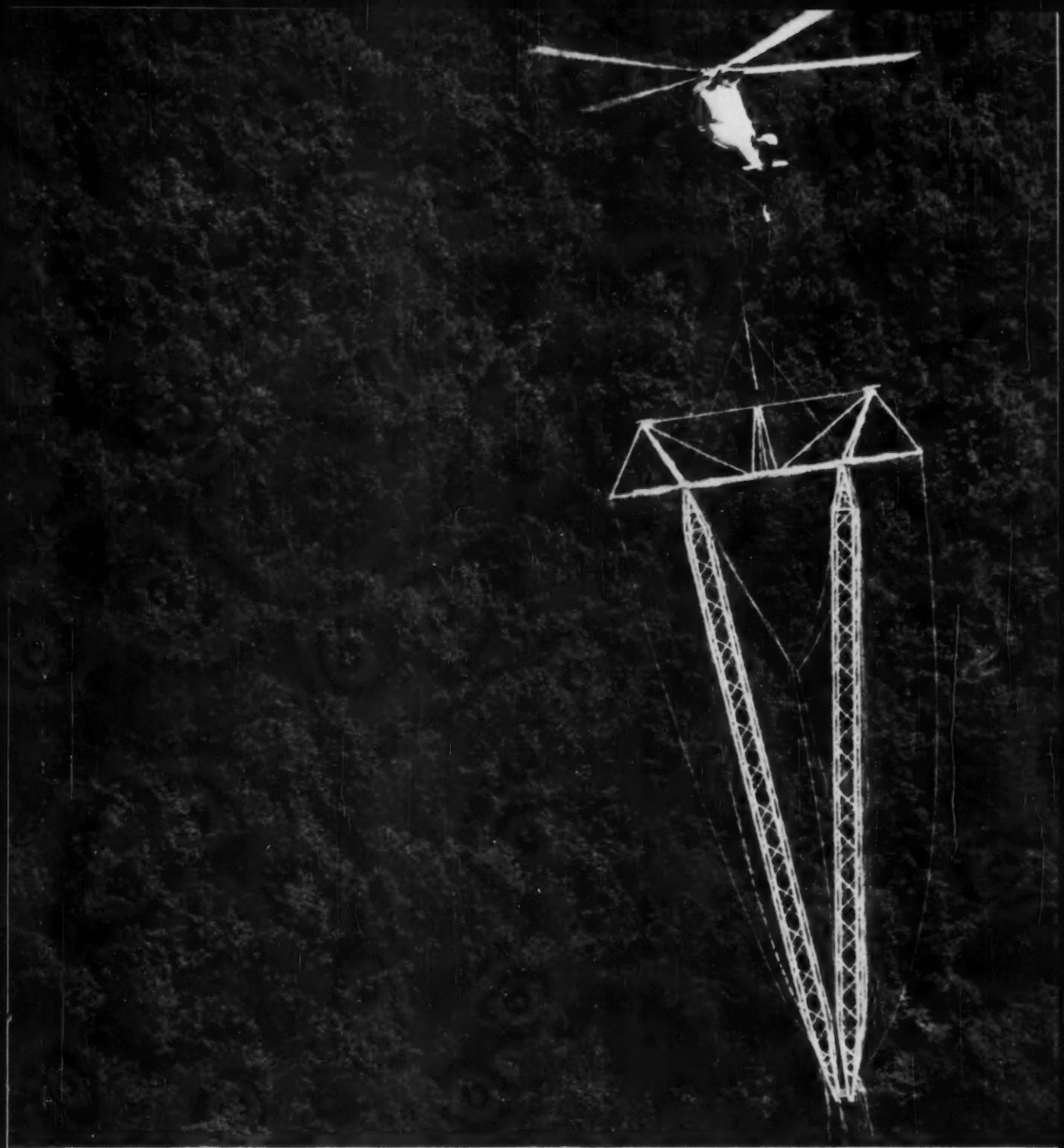
. . . are designed for heavy-duty boring of poles and crossarms. These wooden bits are said to be absolutely free from clogging and to provide continuous boring action which is safer and easier—also much speedier. There are no weld points to break, since the bits are forged in one piece from solid bars of special tool steel. Each bit is heat-treated full length for added strength and for greater safety to the lineman. Available with $\frac{7}{16}$ and $\frac{5}{8}$-in. hex shanks for quick-change chucks and in $\frac{1}{2}$ and $\frac{5}{8}$-in. female square socket drive for direct attachment, the new line includes all popular sizes.

Irwin Auger Bit Co, Wilmington, Ohio

Reference Voltage . . .

. . . portable supply unit, is accurate ac-dc source for meter calibration; also is used to calibrate most ac-dc voltmeters, as a source of accurate ac-dc power to 1 w, as a very precise ac-dc voltmeter in the 0 to 100-v range, and as a general source of ac or dc voltage. Accuracy is $\pm 0.25\%$ of set voltage above 0.01 v and $\pm 0.20\%$ of set voltage ($+ 5\mu$v) below 0.01 v. Unit weighs 16 lb.

Tensor Electric Development Co, Inc, 1873 Eastern Parkway, Brooklyn 33, N. Y.



One minute ago this aluminum tower left the marshalling yard

...in five minutes it will be standing on its foundation

In a history-making experiment in line construction, American Electric Power Company transported and erected a completely assembled V-tower by air.

The aluminum tower, designed for a 138-kv line, was airlifted at the assembly yard, flown 9/10 of a mile, set on its concrete footing, released, bolted and temporarily guyed—all in less than six minutes. With guys, the tower weighed 2,900 pounds—well within the capacity of the Sikorsky S-58 chosen for the job.

The demonstration, conducted by A.E.P.'s subsidiary, Appalachian Power Company, was but one phase of a six-week-long helicopter construction operation. The company used the Sikorsky S-58 to haul steel, poles and assembled H-frames...to erect tower panels ...to string cable. Carrying steel for 17 towers, for example, the helicopter completed what would normally be three weeks' work in just 4¾ hours. Total time to construct 29 miles of line was cut to one-third of that required with conventional methods.

For more facts on helicopter services and the new role of rotorcraft in line construction, simply write Sikorsky.

SIKORSKY AIRCRAFT Division of UNITED AIRCRAFT CORPORATION
Stratford, Connecticut

Operating and Maintenance Superintendent O.L. Hughes (left) of Mississippi Power and Light and J.W. Stone of General Electric compare 1958 Preferred Design Transformer (rear) with 1961 low-height unit.

CUSTOMER FEEDBACK: keeping the "Preferred" in Preferred Design Transformers

Feedback from sales engineers' calls similar to the one above and from 32 special utility meetings held last year has helped General Electric provide power transformers with the latest customer-preferred features:

- Large substation units rated up to 25,000 kva are now 40 inches lower than previous designs, to solve bridge clearance problems.
- Permalex® transformer insulation, which permits operation of units at 65C rise with 12% more continuous capacity and normal life expectancy, is now standard on low-height units.
- Extended ratings for generator step-up transformers increase the upper limit of the Preferred Design line from 250,000 to 400,000 kva.

These and other changes—redesigned cooling equipment and a sealed-tank oil-preservation method on the new low-height units, for example—are the results of a continuing responsiveness to utility needs. Such responsiveness has been the basis of Preferred Design since the concept (first announced in 1957) grew out of a nationwide survey.

To learn how you can benefit from this combination of customer-preferred features and product uniformity, call your G-E Sales Engineer or write to Section 604-17, General Electric Company, Schenectady 5, N. Y., and ask for bulletin GEA-6604B.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Electrical World

SEPTEMBER 25, 1961

Management Newsletter

The Consumer Is Undecided

The consumer apparently hasn't heard about the recovery. With all the talk of prosperity, of higher prices in the future, and with hints of possible controls, he should be making the rounds of retail stores to stock his cupboard. But that's not what's happening. Instead, while all other economic barometers continue to soar, consumer spending is dragging its feet.

Electric utilities can view this consumer indecision as the one dark spot in an otherwise bright economic picture. Utilities, like all industries, are looking for a new economic boom with factories pushing toward capacity in order to meet the consumer's wants. But so far, the consumer hasn't asked for very much at all.

It's not that consumers can't afford the things they want. Disposable income was at a new high of $361.8 billion for the second quarter. And with the exception of a very slight dip in the first quarter of 1961, income rose through the entire recession. Of course, the consumer price index has also been rising, but at only a fraction of the rate at which income has been climbing.

But in spite of the record levels of income, consumers have been avoiding the stores. Retail sales in July were off by $200 million from June levels on a sea-

sonally adjusted basis. The drop was spread evenly—durables down $100 million as were non-durables. This puts July's retail sales at just about the same level as the March figures. It's also slightly below the monthly average for 1960. And, don't expect to see a big jump in August figures. Weekly department store sales for August indicate only a modest gain in total retail sales.

A look at consumer credit gives the same picture. In June, consumer credit outstanding increased about $400 million against a June, 1960, increase of $670 million. Furthermore, monthly figures since the first of the year show that the consumer has cut back a bit on installment credit outstanding. Up until now, repayments have run slightly ahead of new installment credit extensions.

The July survey of consumer buying intentions, conducted for the Federal Reserve by the Bureau of the Census, offers little encouragement for the immediate future. According to the July survey, consumer plans to buy automobiles have turned up since April. But the proportion of families with plans to buy major household durable goods was down since the April survey, and was smaller than in either of the two preceding July surveys. Plans to purchase houses during the coming year were at about the same level as the three previous surveys, but were lower than in July, 1960.

CONSUMER SPENDING PACES THE ECONOMY

Consumer sluggishness, if it continues, could easily kill off a business boom in the bud. True, government spending is high, and will probably be higher in the future. But government spending is not the most important element in the economy. The consumer, accounting for about two-thirds of national spending, is by far the more important.

In addition, what consumers do greatly influences the effect of government spending on the economy. This is because each dollar that the government spends becomes income to private citizens. As the citizen spends this income, it becomes new income for other citizens who in turn, provide income for still more people by their spending. Thus, depending on how much of income consumers spend, every dollar of investment, whether spent by government or by business, becomes several dollars of income for the economy.

Economists call this a "multiplier effect." When consumers are spending most of their income, this multiplier is high. But when they cut-back on spending, as they are doing now, the multiplier is low, lowering the effect that new investment has on the economy. So, despite additions to inventory and increased government outlays, an economic boom will have to wait for the consumer to spend. And, as of now, he seems undecided.

But the outlook isn't nearly as bleak as current indicators of consumer activity would make it appear. There are several reasons why you can expect a revision in consumer intentions to buy, and why retail stores can expect plenty of activity in the near future.

First of all, consumers will hold only a certain portion of their income in savings. And savings are already at a high level. In the second quarter, savings as a percent of disposable income hit 7.1%, the highest level since the 1958 recession. As income continues to rise, we can expect consumers to cut down on the percentage going into savings and repayment of old debts, and to bring more with them to the shopping center.

Some items, of course, must be purchased on credit. And consumers are getting into position to start a new round of credit buying. As was stated earlier, repayments have run ahead of new extensions of installment credit during this year.

This means that many families are eliminating old debts, and are therefore putting themselves into a position to make new purchases of durables on time. But even these factors aren't sufficient to start a buying boom.

PSYCHOLOGY OF THE CONSUMER IS IMPORTANT

Psychology also plays an important part in consumer spending. Just having the buying power isn't enough. The consumer also has to feel secure in his job. He has to feel that the rainy day against which he might need savings is remote, and that his income is secure enough for him to contract for a series of installment payments.

During recessions consumers whose income is unaffected nevertheless cut back on spending because they are uncertain about the future of that income. And they don't start buying again until a business recovery is able to erase the last traces of pessimism.

Why should consumers be pessimistic when so many indicators of business activity are posting new highs? The obvious answer is the level of unemployment. Unemployment in July, on a seasonally adjusted basis, was at 6.9% of the work force, as high as it has ever been. And until this figure is cut substantially, job holders view their position as precarious. Mentally, they put themselves in the same position as those actually unemployed. Feeling that they may be next, they refuse to dip into savings except for absolute necessities.

But economists see signs that the unemployment figure may be dropping. There has been a steady rise in weekly hours of work figures. Since January, each month has posted an advance with the average hours worked per week in July at 40.1. This indicates that present work force is being pushed to the limit, and that future expansion in industry may well make a dent in the current unemployment level.

Perhaps the increase in hours worked has already had some effect on consumers attitude. The July survey of consumer buying intentions did turn up one very promising note. 24.7% of the families interviewed expected to be enjoying higher incomes a year from now than they are at present. This is the highest percentage of families voicing optimism since the October, 1959 survey.

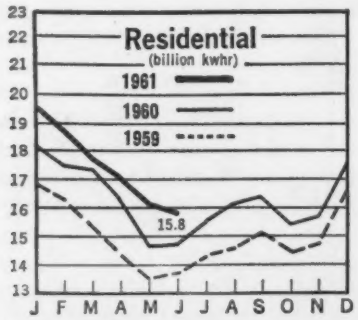
Once the unemployment figure breaks and starts downward, we can look for this seed of optimism to blossom. When it does, the buying power will be ready and waiting and you can look for retail sales figures to head upward. The McGraw-Hill department of economics has studied the outlook, and concluded that "consumers will probably increase their expenditures on goods and services about $19 billion in the ten months ahead."

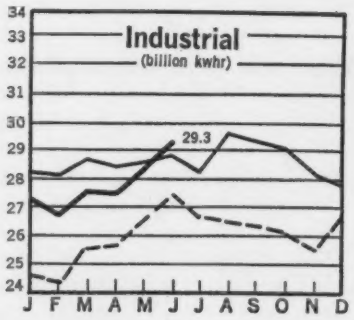
RETAIL SALES FIGURES BEAR WATCHING

But this is only expectation based on the factors which should influence the consumer to buy. The final decision is his. And while we have been able to erase the recession on the strength of a turn in inventory policy, business investment, and government spending, the economy can't continue upward unless the consumer lends his support.

At this stage of the business cycle, consumer spending is the important indicator. If it remains sluggish, the current climb will flatten out. But if consumer spending turns up, as it is expected to do, then it will confirm the boom which so many business forecasters have been predicting. In short, from here on, the economy is in the hands of the consumer. Keep your eye on him.

Monthly Sales of Electricity . . . through June





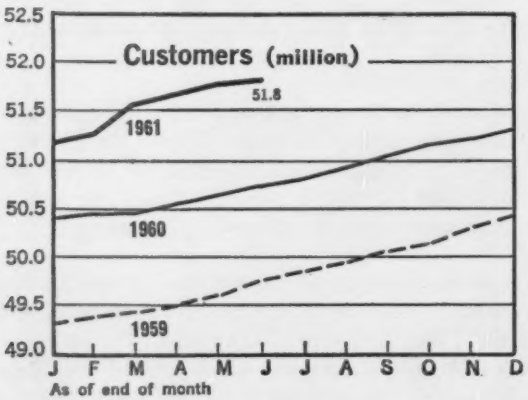
SOURCE: EDISON ELECTRIC INSTITUTE

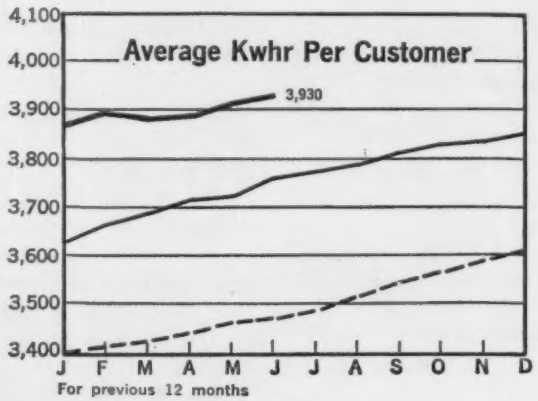
Power Statistics . . . through June

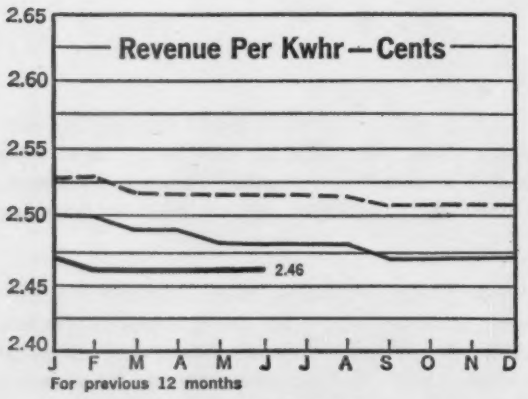
	Latest Month	Year Ago	Annual Change %
Capacity..... million kw.....	174.44	162.07	7.6
Total Production..... billion kwhr.....	65.19	61.92	5.3
Hydro	13.46	12.45	8.1
Fuel	51.73	49.47	4.6

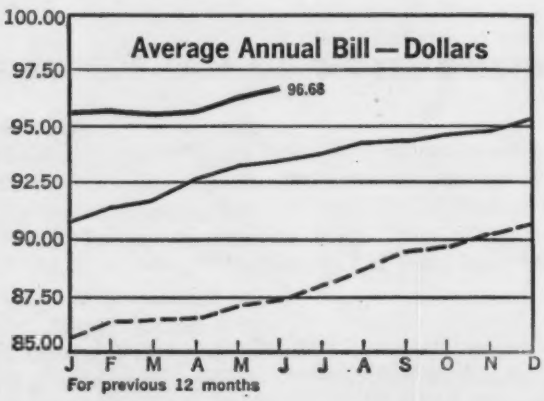
SOURCE: FEDERAL POWER COMMISSION

Residential . . . through June



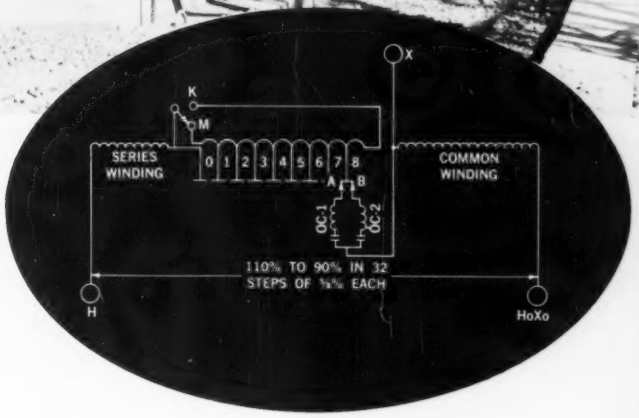






SOURCE: EDISON ELECTRIC INSTITUTE

ALLIS-CHALMERS



Now available from Allis-Chalmers only... Line-End *load tap changers for ratings up to 230 kv and above*

With the growing number of interconnections requiring high-voltage and extra-high-voltage autotransformers, utility engineers have long been seeking a more efficient, lower cost LTC mechanism.

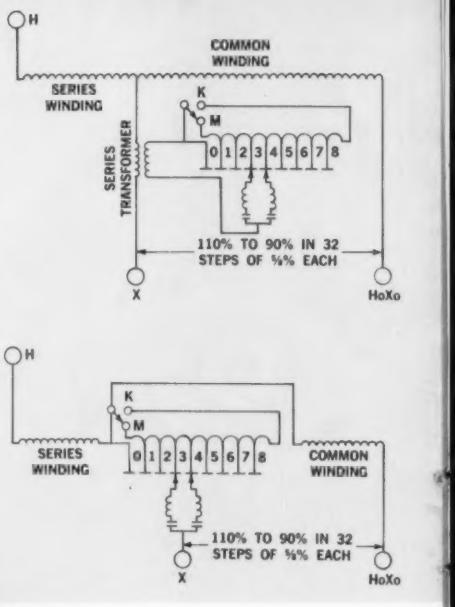
As far back as 1928, Allis-Chalmers supplied a bushing-mounted mechanism but abandoned it in favor of the less complicated though bulkier series transformer design.

Now, in the new LINE-END tap changer, Allis-Chalmers offers the utility industry the best of both approaches. The LINE-END design is reliable and simple — proved dependable in two years' operating experience . . . with over 1,600,000 kva installed on commercial systems. In addition, by eliminating the need for a series transformer, A-C offers savings in size and weight . . . plus lower losses and increased efficiency.

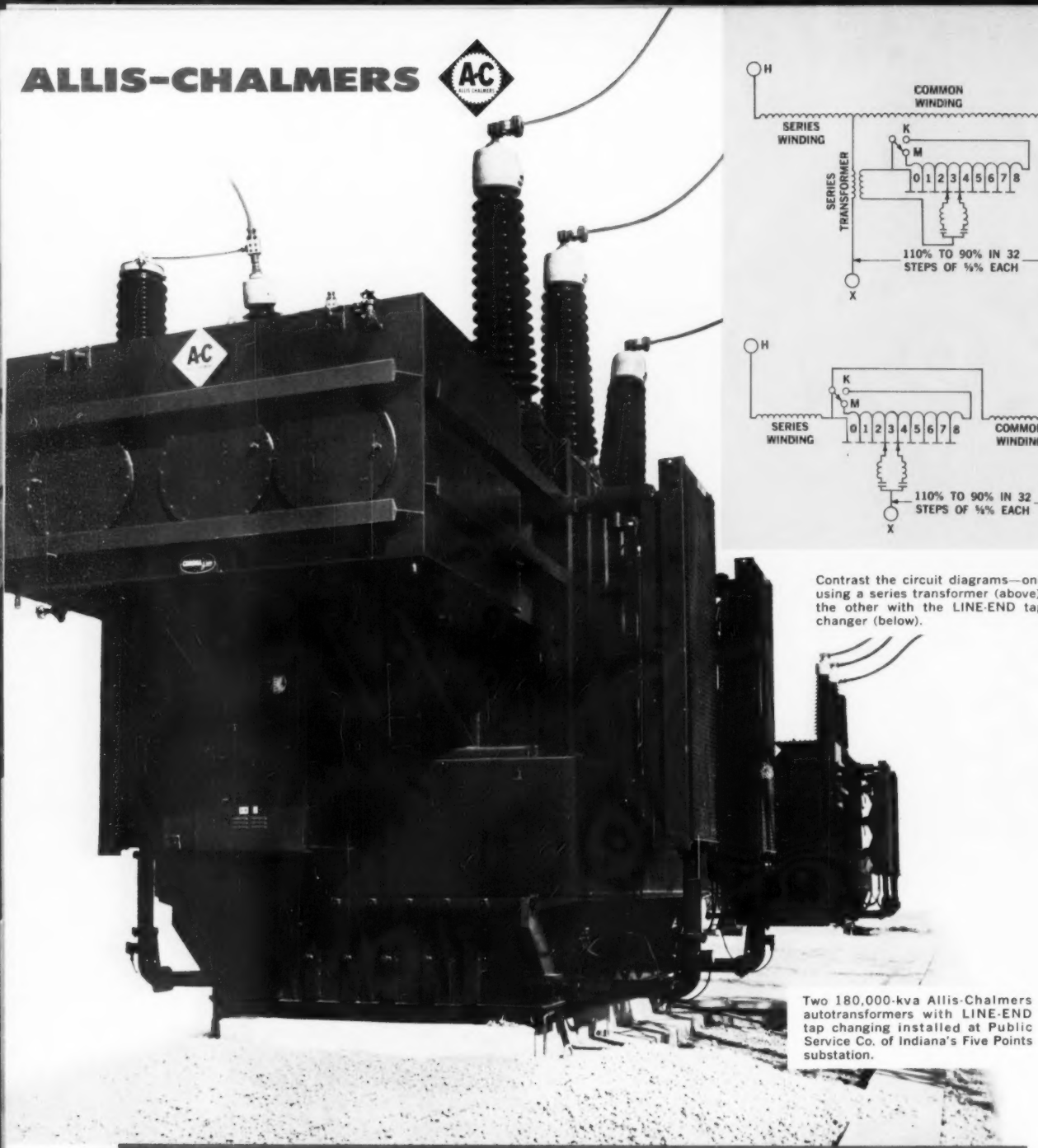
A-1540

For the facts on this new approach to LTC, turn the page . . .

ALLIS-CHALMERS



Contrast the circuit diagrams—one using a series transformer (above), the other with the LINE-END tap changer (below).

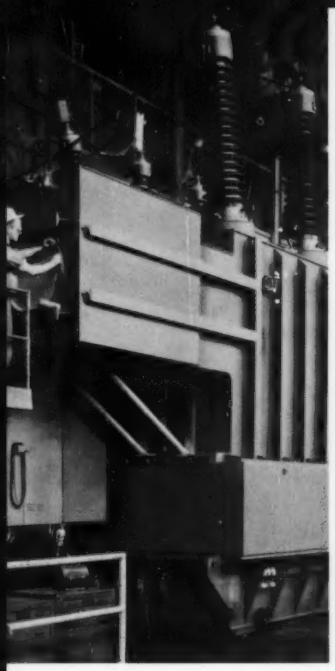


Two 180,000-kva Allis-Chalmers autotransformers with LINE-END tap changing installed at Public Service Co. of Indiana's Five Points substation.

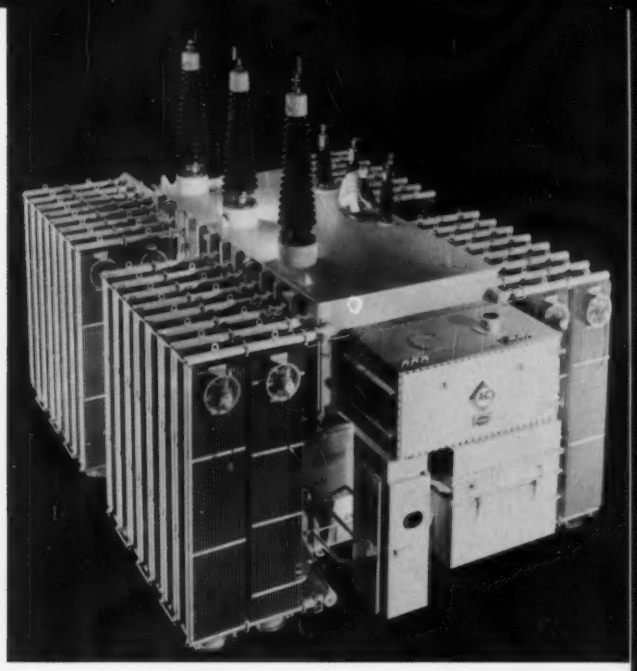
Compare these two 50/83-mva autotransformers installed at the Central Power & Light Co. within a few months of each other.

Characteristic	Series Type	LINE-END	% Improvement
Total Weight (lb)	316,000	246,000	22%
Floor Space (sq ft)	700	570	19%
Total Losses (kw)	208	166	20%

Rated 138/69 — 12.5 kv, with ±10% LTC in 69-kv circuit



Access ports are easily reached on A-C autotransformers with LINE-End tap changers. View through port displays rugged yet simple current-interrupting contactor and barrier bushing.



LINE-END tap changer is also applicable to delta windings. This 250-mva transformer is shown prior to shipment to a major West Coast utility.

20% smaller...20% lighter

LINE-END load tap changers offer 15% average lower losses

Combining its 37 years of building load-tap-changing equipment with famed corona-free design, A-C has developed for the industry a line of tap-changing equipment in sizes 50,000 kva and larger through the extra-high-voltage range.

BY ELIMINATING THE SERIES TRANSFORMER — the LINE-END tap changer accomplishes the following (see also table at left):

Lower losses — *an average of 15% less* — with consequent increases in efficiency — and the added bonus of stabilized tertiary voltage.

20% less floor space — Compact design fits existing substations. For new sites, savings in real estate, pad, overhead structure can be realized.

20% lighter — One-piece shipment with permanent cover in place is now possible for larger units. Attendant economies in time and labor for field assembly are great . . . as are the cost reductions in moving transformers from railroads to substation sites.

BY LOCATING THE DIRECT-ACTION MECHANISM ON THE MAIN TANK, the LINE-END tap changer provides the following economies:

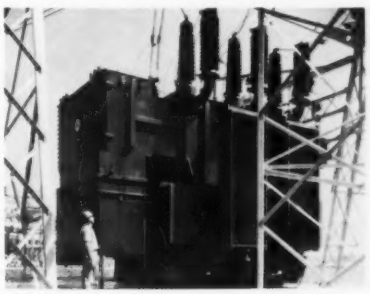
Simplicity adds reliability — Absence of several long shafts and sets of bevel gears makes mechanical synchronization of three phases far simpler. Only two shafts, both straight, are required on the direct-action LINE-END mechanism.

Sharply reduced maintenance — only one seal to maintain. And the mechanism is easily accessible at main tank height.

Greater safety — No need to use ladders on top of the transformer for routine inspection and service.

Utilizes standard bushings — Replacement can be made from stock. Hence no special bushing inventory is required.

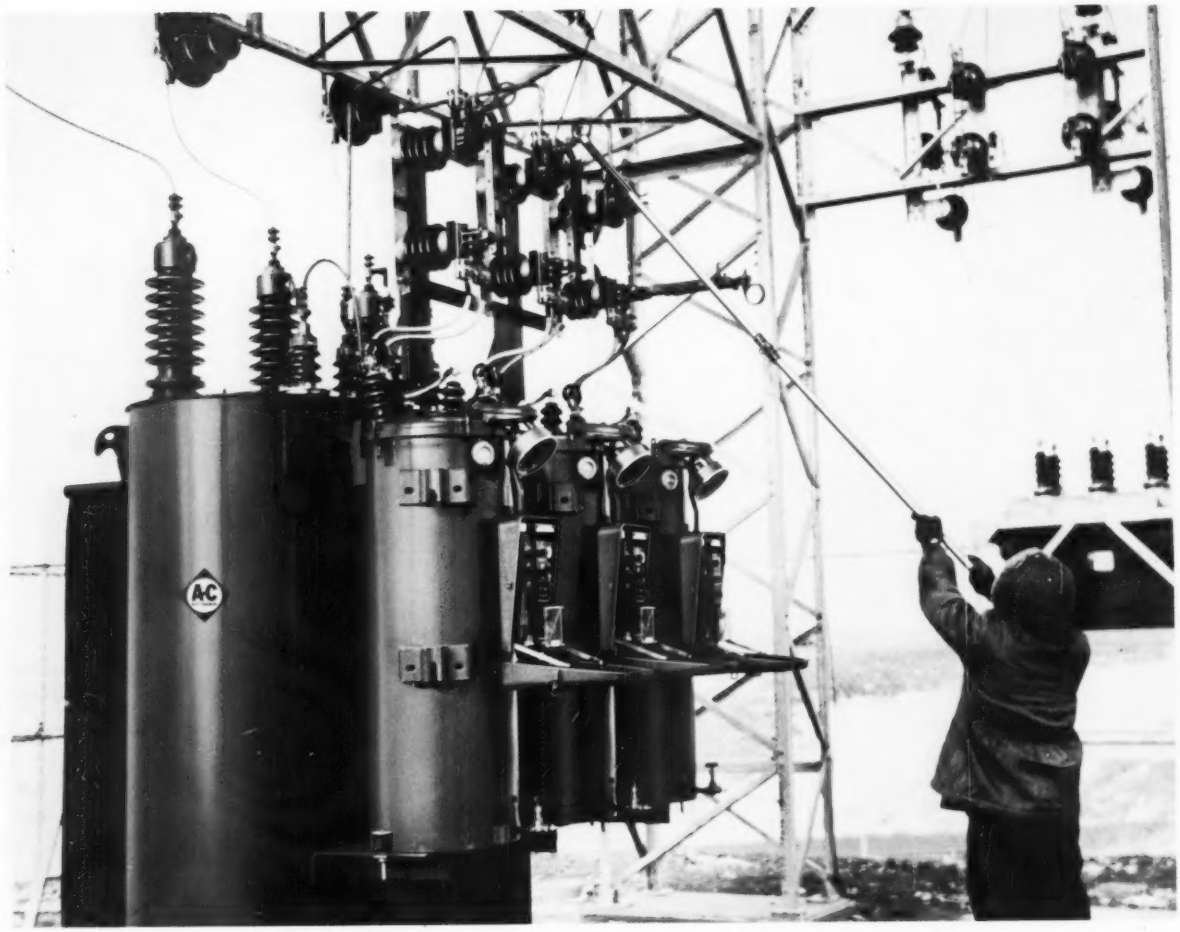
For Bulletin 01B1052, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.



On the lines of a Texas system — a 200-mva, 132/66-kv autotransformer with LINE-END tap changer. This company also has a 100-mva LINE-END-equipped unit.

ALLIS-CHALMERS

ALLIS-CHALMERS



Now! Safe by-pass of regulation equipment

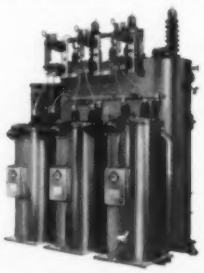
No service interruption with new Regu/Tran units

Hook-stick-operated for maximum personnel safety . . . all by-pass switch operations are performed in proper sequence. All three switches are fully visible from a single vantage point. Each by-pass switch opens both leads to the series windings . . . interrupts exciting current . . . *without interrupting the load.* Locks securely — eliminates any danger of accidentally dropping load.

These versatile switches are just one example of *Regu/Tran* unit flexibility. This unique, integral assembly offers true independent phase regulation. The three single-phase regulators improve voltage control, increase revenue. It's the economical answer to the problem of unbalanced loads and varying lengths of single-phase feeders.

- **MINIMUM INVESTMENT**—Buy Regu/Tran transformer first. Add regulators, by-pass switches as you need them.
- **TAILORED REGULATION** — If just ±5% regulation is needed, that's all you purchase. No need to pay for unused voltage range.
- **VERSATILITY** — Use transformer or regulators as separate units.

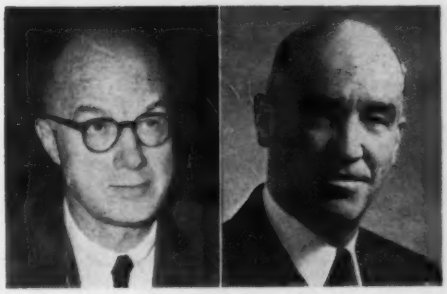
More Regu/Tran *unit facts? Call your nearby A-C office or write* **Allis-Chalmers,** *Power Equipment Division, Milwaukee 1, Wisconsin.*



Regu/Tran is an Allis-Chalmers trademark. A-1441

News About People

Service Corp Head Chosen



RICH ABBOTT

New England Gas & Electric Assn has chosen John F. Rich to become president of its Service Corp. The association has also promoted Charles T. Abbott to the position of executive vice president for the Service Corp.

Currently chief executive officer for New England G&E Assn and its subsidiary operating companies, Rich succeeded Hall M. Henry who will continue to serve with the Service Corp as a vice president, director and consultant. Abbott was formerly a vice president of New England G&E Assn Service Corp.

Philadelphia Electric Boosts Gilkeson to Vice President

GILKESON ▶

Robert F. Gilkeson has been elected vice president in charge of engineering and research for Philadelphia Electric Co.

Gilkeson joined the utility in 1939 as a junior engineer. After military service during World War II, he entered the electric generation department and received promotions there. He took a two-year leave of absence from 1951 to 1953 to serve in Westinghouse Electric Corp's atomic power division. Following his return to the utility as assistant superintendent of generating stations, Gilkeson became Eddystone station superintendent in 1956 and engineering and research department manager last year.

PERSONAL BRIEFS

C. Eugene Glasco has been named senior electrical engineer at Columbus & Southern Ohio Electric Co. **Raymond V. Watkins** became system relay engineer in the system dispatching department.

At Ohio Power Co, **Herbert C. Doughty** has been appointed general superintendent of transmission and distribution, succeeding **William M. Ruddicks** who has been named a consultant in the general office in Canton.

Leonard Sloan has been elected assistant treasurer and assistant secretary of Jersey Central-New Jersey Power & Light Companies.

South Indiana Gas & Electric Co has boosted **Harry W. Reed** to foreman in the electric transmission and distribution department.

Richard C. Davies has joined the West Coast product specialist staff of Sprague Electric Co's transistor division. His headquarters will be in Los Angeles.

Philip B. Taylor has been elected a director of General Precision Equipment Corp.

Thomas E. Buckley has become executive assistant to the chairman of International Business Machines Corp. He succeeded **Robert W. Hubner,** recently named marketing services director.

Barkelew Electric Manufacturing Co has named **Thomas J. Barkley** as sales manager.

OBITUARIES . . . Thomas W. Connette, 70, former vice president and manager of New York State Electric & Gas Corp . . . **Glen E. Arbogast,** 77, chairman of Newbery Electric Corp . . . **Ferdinand W. Dohring,** 62, retired vice president and general sales manager for Elliott Co.

Worthington Picks Barno To Become Vice President

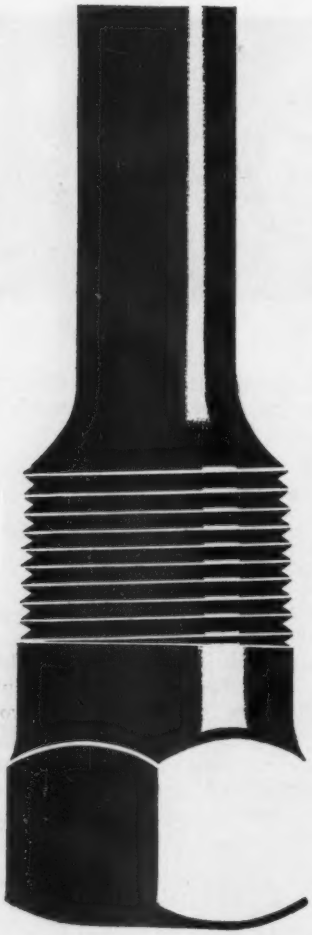
BARNO

Peter S. Barno has been elected vice president-employee and public relations for Worthington Corp. He succeeds William A. Meiter, recently named vice president-Washington D. C., services.

Klinger Gets Sales Post

James R. Kearney Corp has appointed T. M. Klinger as product sales manager. He has been a Kearney sales engineer for 11½ years.

(*More News About People on p* 84)



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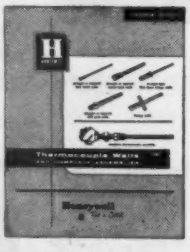

Get complete details from your nearby Honeywell field engineer, or write today for Catalog G100-5.

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Honeywell

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SINCE 1906

SALES ASSIGNMENTS

COMPANY STAFFS

Cohu Electronics, Inc, has appointed Herbert G. Hoefler as New England sales manager for the Massa division. Hoefler was formerly sales manager of Atlas Controls, Inc.

Kennecott Copper Corp has transferred Howard Lanier, former quality control engineer at Utah Copper division refinery, to Kennecott Sales Corp. With headquarters in New York City, Lanier is manager of selenium and columbite sales.

RT&E Corp has named Edison W. Lytle northeastern sales division manager. Charles H. Kyle succeeded Lytle as sales representative in central Ohio, western New York, Pennsylvania, and West Virginia.

A. B. Chance Co has appointed the following sales representatives: Clifford L. Richardson, line construction materials representative for the Los Angeles and San Diego area; Morgan O. Ogilvie, line construction materials representative for Alabama, Georgia, and western Florida; Carl R. Larrabee Sr, electrical apparatus representative for the New England area; and James Mosimann, electrical apparatus representative for Colorado, northern New Mexico, eastern Wyoming, and western Kansas and Nebraska.

Union Carbide Corp has transferred Douglas L. Peterson from the north central sales region to the south Atlantic region of Union Carbide Plastics Co division. He is located in the company's Moorestown, N. J., regional sales office. John R. Peterson became Cleveland district sales office manager for the company. He is headquartered at 1300 Lakeside Ave, NE, Cleveland, Ohio. Richard A. Daily was transferred from the south Atlantic sales region to the Minneapolis, Minn., sales office of Union Carbide Plastics. He is located at the district sales office at 4010 W 65 St.

Pfaudler Permutit Inc has established a new industrial sales office in Dallas for the Permutit Co division. The office, located at 3603 Lemmon Ave, is directed by Austin F. McCormack.

Thompson Ramo Wooldridge Inc has opened new offices in Atlanta and Washington, D.C. H. E. Kurzweg was named regional manager for television products in Atlanta and J. A. Rickel became regional manager for the Washington office. Thad Harris was appointed regional field engineer for CCTV in Atlanta and Carl J. Hayworth assumed a similar post in Washington. TRW also opened a new regional office in New York City. James J. Childs was named eastern regional manager for industrial control systems and is located at 200 E 42 St.

Allis-Chalmers Manufacturing Co has appointed Donald J. Powers as resident representative in Fort Wayne, Ind. He serves the northern portion of the Indianapolis territory.

General Electric Co has named Neil E. Billman as its east central district sales representative for the silicone products department. Billman's office is located at 21590 Greenfield Rd, Oak Park, Mich.

Urges Relaying for Tree Faults

(*Continued from page* 41)

the uncontrolled cold flow of aluminum conductors under pressure. The compensated connector, with a recessed circular fulcrum for dishing the washer, has an average loss of 40 in.-lb from the original torque of 240 in.-lb. Loss for an uncompensated connector is 110 in.-lb.

A mobile substation used as a spare at substantions under construction has brought savings to the City of Tacoma, Wash. No longer needing spares, Tacoma City Light now purchases 3-phase instead of single-phase transformers.

Several thousand circuits may be interconnected over a single microwave path through a new 600-channel multiplexing system, said E. E. Combs, Lynch Communications Systems. The system uses channel, group, and super-group drop and re-insert facilities. Filtering techniques, said Combs, simplify greatly the complex arrangements at microwave repeaters, where large blocks of channels are dropped and reinserted.

Describing Kennecott Copper Co's dc power system at its Balti-

more Refinery, D. T. Young said that superior power factor characteristics had wrought dramatic reductions in capital expenditure.

Each rectifier, he said, is adjacent to its electrolytic load, rather than located centrally with regard to the whole plant, previously the usual position of rotating machines. These rectifiers are remotely controlled, so that production operators are free to perform their functions.

As in older installations, the 90-ton furnaces melt copper at 40 tons per hr. Depending upon the amount of preheating, melting consumes 180 to 250 kwhr per ton of charge. Average plant power consumption is about 700 kwhr per ton, 16,000 kw average demand at about 70% load factor.

Load composition, through varying with the operating cycle, ordinarily is 25% for electrolytic cells, 40% for arc furnaces, 20% for motor loads, and 15% for lighting and miscellaneous purposes, he said.

Network transformers replaced the load-center type in the primary distribution system of a new high-rise office building in Kansas City, Mo., related J. P. Kessler and B. J. Stables, Black & Veatch.

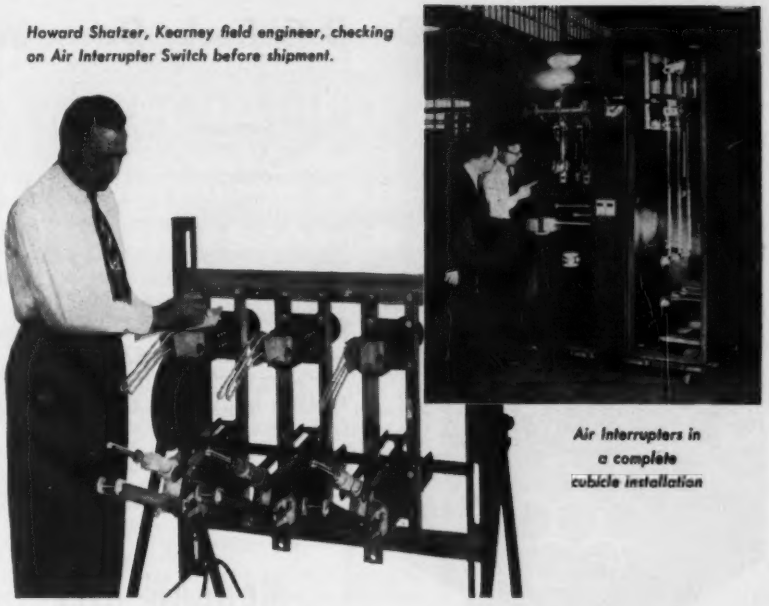
The substitution, they said, brought lower losses and noise rate as well as savings due to smaller size and weight. These advantages warranted the change, despite a 10% increase in initial cost.

Each primary transformer, whether in the basement or on the roof, is fed by either of two 13.2-kv sources. Secondary systems on each floor are supplied by 1,600-amp vertical bus ducts.

Metering of 16 all-electric apartment units in Salt Lake City revealed that the heating peak seldom coincided with the system peak, said F. O. Wald and R. S. Patrick, Utah Power & Light Co. Inspection of daily load data, they added, indicated that the heat load was generally low when other appliance loads were high.

Peak load for the 16 units during the year of tests was 73.8 kw, in contrast with 221.5 kw determined by code methods for establishing service and feeder sizes, they said, noting, however, that the code computation of 17.9 kw peak load for a single apartment corresponded closely with the 17.4 kw peak metered in the study.

Howard Shatzer, Kearney field engineer, checking on Air Interrupter Switch before shipment.



Air Interrupters in a complete cubicle installation

Specify KEARNEY...

for safe AUTO · SPEED interruption

in metal-enclosed switchgear

What is Auto-speed interruption? . . . An automatically produced interruption that always occurs at the same point in the switching operation, and always takes the same time (one-half cycle). Human error is eliminated from the switching action by a trigger spring mechanism which trips the switch at a pre-set point. Contacts are separated inside a dry type interrupter unit.

Specify safety for personnel and equipment. No exposed Arc. Kearney Air Interrupter Switches will not produce external arcing dangerous to men or equipment.

Specify economy. Costing less than circuit breakers and with interrupting capacity not found in air break disconnects, Kearney Air Interrupters are ideal for . . . interrupting magnetizing charging current of transformers . . . interrupting charging current of lines and busses . . . interrupting exciting current of feeder regulators . . . interrupting load currents to rated capacity . . . sectionalizing feeders and distribution circuits.

Specify Engineering Ability. Kearney's staff of engineers is experienced in adapting or combining equipment for complete switching centers or additions to existing units. Designing for unusual needs . . . corrosive or dusty atmospheres, unique space requirements, portable units, or carefully calculating tomorrow's expansion requirements . . . we are geared to handle the unusual.

Kearney Air Interrupter Switches are made in ratings up to 15 K.V.

3E's reliable Interrupter is now a Kearney product... unmatched for economy and safety

Write for Bulletin 152

KEARNEY

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A B C

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Crapo Galvanized Steel Strand is available in three weights of coating, Class A, B and C. Class B has twice the zinc by weight per square foot of wire surface as Class A; Class C has three times that of "A."

Contact the **Crapo** Galvanized Steel Strand distributor near you for prompt shipments from his stock or from our mill.

INDIANA
Steel & Wire Co., Inc.
Muncie, Indiana

B. C. Backs Down in Stock Controversy

Premier W. A. C. Bennett of British Columbia has backed down in the face of mounting criticism and agreed to offer $104 million in 25-year-term government bonds to holders of British Columbia Electric Co preferred stock.

The Cabinet passed an order-in-council to entitle holders of perpetual yield bonds to exchange them before August 2, 1962.

Following its take-over of B. C. Electric last month, the B. C. government said preferred holders would receive perpetual bonds for their securities. The bonds' interest would be equal to the dividend rate of the stock and would be callable at the government's discretion.

The action set off a storm of protest by investment groups and others who felt expropriation had penalized preferred stock holders and that the perpetual bonds would cause further hardship because they would trade below par.

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30 Rural Electric Cooperatives
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Exec V P.....W H Zimmer
V P, Elec Dept.....S M Hamill, Jr
V P, Rates.....C M Turner

MAJOR INTERCONNECTIONS WITH OTHER ELEC COMPANIES

Utility	Max Tie Kva	Tie Voltages
Ind & Mich E Co		132 kv
Pub Serv Co, Ind Inc		132/66 kv
Louisville G & E Co		132 kv
Dayton Pwr & Light Co		132/66 kv
Tenn Valley Authority		132 kv
Ohio Valley E Corp		132 kv
Ohio Pwr Co		132 kv

1960 Net Sys Input 5,358,720,851 kwhr.
1960 Power Pur 65,112,600 kwhr.
1960 Sales / Elec 4,957,576,212 kwhr.
No / Transm Substa 28 Tot kva 2,678,632.
No / Distr Substa 149 Tot kva 948,847.
Transm Volt Abv 69 kv 132 kv, Cir Miles 275.
Transm Volt Abv 22 kv 33-66 kv, Cir Miles 797.
Distr-Prim Volt 4.15 - 13.2 kv, Pole Miles 5,716.
Underground Cable Miles: Transm 21 Prim Distr 434

Tot Cap as / January 1, 1961 1,228,000 kw.

1961 Edition Offers Many More Data

Newly published by McGraw-Hill Publishing Co, Directory of Electric Utilities for 1961 is a thoroughgoing revision of all previous editions with three and a half times as much information. But more concise organization of the text has kept the increase in size to less than a hundred pages.

This 70th edition, based on the 1960 US census, shows up to 23 new managerial titles; data on electric customers broken down into residential, commercial, industrial, rural and other customers; major interconnections; system energy outputs, circuit miles of transmission lines and plant fuels; and extensive further information about electric utilities. Included are 373 investor-owned utility companies, 1,865 municipals, 934 co-ops, irrigation districts and other public utilities in the US and possessions and in Canada.

The 942-page directory is priced at $55. The Canada section separately costs $10. Individual state sections range from $5 to $8 to buyers of a complete directory.

Selling

City Leases Electric Distribution System

Weleetka, Okla., recently voted to lease its electric distribution system to Public Service Co of Oklahoma for 25 years. The residents also elected to permit use of streets and alleys by the company in providing service to the community for the lease period.

Under the terms of the agreement, the company will pay Weleetka $20,000 a year to utilize the system, plus a 2% franchise tax on commercial and residential sales. Public Service will also pay 5% of all revenues over $50,000 to the city. One effect of the lease is the availability to residents of the generally lower rates of PSC.

Installation of 20,000-lumen mercury vapor lights was begun immediately following the election. Thirteen lights on the main street were installed as part of PSC's facilities.

Public Service will operate and maintain the system throughout the lease period, and will keep records of all additional plant installed. At the end of the period, the company and Weleetka will determine whether the agreement will be renewed. In the event that it is not, the city has the option of selling its portion, or buying PSC's portion.

Better Office Lighting Sought in Chicago

A joint committee to promote an extensive and comprehensive program for better office lighting has been formed by the Electric Association of Chicago and the Chicago Lighting Institute as the basis for an all-out drive in the Chicago area. The target of the program is better lighting for about 800,000 executives, secretaries, and other office personnel who are working under lighting conditions considered adequate 20 years ago.

The first committee project was the setting-up of a basic six-lesson lighting course for contractors, distributors, and manufacturers, covering the theory and application of adequate lighting.

talk to the SPECIALISTS in...
• TRANSFORMER COOLING RADIATORS
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Shaw-Perkins Transformer Cooling Radiators, design standard for the transformer industry, give you the *full* economy and dependability of thermo-siphon self-cooling. Sizes and models for any make or capacity of transformer, either rebuilt or new. MAX/FLO oval tubes assure optimum heat dissipating surface, free flow characteristics. Complete range of flanges, elbows, valves, and other accessories are available for all mounting conditions.

Transformer tanks, another product of Shaw-Perkins specialized engineering, are built to customer specification, in sizes from pole line distribution types to power transformers up to 3750 KVA.

Write today for information and new catalog on transformer radiator and tank accessories.

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201 East Carson St. • Pittsburgh 19, Pa.

Street Light Control Shrugs off Killing Transient Voltages

How can a compact, lightweight photo control withstand the control-killing effect of a wide range of transient voltages?

Use Varistors to absorb surges which are below the spark-over of lightning arresters. Let the lightning arrester handle the higher transients.

That's the story on simple, reliable, surge tested LUMATROL MARK I*

Write for Bulletin 91a.

**Lumatrol Mark II, for 230 Volt circuits, is described in Bulletin 92.*

LUMATROL MARK I

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3—1500 KVA G-E 69000—7200/12470Y
3— 500 KVA A-Ch 2400/4160Y—240 x 480
3— 500 KVA A-Ch 7200/12470Y—240 x 480
3— 500 KVA A-Ch. 13200—240 x 480
3—1000 KVA G-E 34500-7200/12470Y
3—1000 KVA Wag. 34500—2400/4160Y
3— 833 KVA W-H 43800—480
3— 500 KVA Penn. 13200—120/240
3— 333 KVA W-H 13200—2400/4160Y
3— 333 KVA G-E 2400/4160Y—240/ 480
3— 333 KVA Wag. 2400—120/240
1—1500/1875 KVA Mol. 3-Ph. 34,500—2400 F/C equipped

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Minimum 5 years experience designing power and lighting for industrial, chemical and metallurgical plants required.

Must be capable of handling design and related problems from inception to final completion.

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for
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Meetings Calendar

OCTOBER

American Gas Association—Annual Meeting, Dallas, Oct. 1-4.

Electric Council of New England—Management Training Course, Bald Peak Colony Club, Melvin Village, N. H., Oct. 1-7; Residential Sales Workshop, Hotel Wentworth-By-The-Sea, Portsmouth, N. H., Oct. 2-3; 5th Annual Conference, Hotel Somerset, Boston, Mass., Oct. 18-20.

• **Iowa Utility Companies**—14th Annual Management Conference, Des Moines, Iowa, Oct. 2-3.

• **Tennessee Valley Public Power Association**—Power Use Section, Hotel Peabody, Memphis, Tennessee, Oct. 2-3.

• **Institute of Radio Engineers**—Canadian Electronics Conference, Automotive Building, Exhibition Park, Toronto, Canada, Oct. 2-4.

• **Southern Research Institute**—Conference on Future Technological Trends, "Coal's New Horizons," Dinkler-Tutwiler Hotel, Birmingham, Alabama, Oct. 3-4.

• **Electrical Association of Philadelphia**—Delaware Valley Electrical Progress Show, Convention Hall, Philadelphia, Oct. 3-5.

• **Indiana Electric Association**—Annual Convention, French Lick-Sheraton Hotel, French Lick, Indiana, Oct. 4-6.

• **International Association of Electrical League**—Annual Conference, Hotel President, Atlantic City, Oct. 4-6.

• **Northwest Public Power Association** — Accounting and Finance Section, Annual Workshop, Snohomish County PUD Auditorium, Everett, Washington, Oct. 5-6.

Pennsylvania Electric Association—Structures & Hydraulics Committee, Fort Bedford Inn, Bedford, Penn., Oct. 5-6; Electrical Equipment Committee, Penn Alto Hotel, Altoona, Penn., Oct. 5-6; Communications Committee, Lawrence Hotel, Erie, Penn., Oct. 12-13; Business Development Section, Bedford Springs, Penn., Oct. 19-20; Meter Committee, Uniontown, Penn., Oct. 19-20.

• **NEMA**—Technical Committee Hydraulic Turbine Section, The Greenbrier, White Sulphur Springs, W. Virginia, Oct. 5-6; Industrial Electronics & Communications Equipment Division, Edgewater Beach Hotel, Chicago, Oct. 26.

International Association of Electrical Inspectors—Eastern Section, Annual Meeting, Warwick Hotel, Philadelphia, Penn., Oct. 9-11.

National Electronics Conference—Annual Meeting, Sherman Hotel, Chicago, Ill., Oct. 9-11.

• **American Standards Association**—National Conference on Standards, Rice Hotel, Houston, Oct. 10-12.

Edison Electric Institute—BLBS Executive Committee, Chicago, Ill., Oct. 11; Transmission & Distribution Committee, Ft. Des Moines Hotel, Des Moines, Iowa, Oct. 12-13; Electrical System & Equipment Committee, Jack Tar Hotel, San Francisco, Oct. 23-24; Home Service Committee, Chicago, Ill., Oct. 24-25; Sales Division Executive Committee, New York, N. Y., Oct. 31.

• **National Rural Electric Cooperative Association**—Region X Meeting, El Paso, Texas, Oct. 12-13; Region VI Meeting, Bismarck, North Dakota, Oct. 16-17; Region VII Meeting, Cheyenne, Wyoming, Oct. 19-20; Region II Meeting, Miami Beach, Florida, Oct. 30-31.

American Institute of Electrical Engineers—Fall General Meeting, Statler-Hilton Hotel, Detroit, Mich., Oct. 15-20.

Northwest Electric Light & Power Association—Business Development Section, Davenport Hotel, Spokane, Wash., Oct. 16-18.

National Safety Council—Annual Meeting, Chicago, Ill., Oct. 16-20.

Wisconsin Utilities Association—Operating and Sales Convention, Schroeder Hotel, Milwaukee, Wis., Oct. 18-20.

• **Illinois Municipal Utilities Association**—Fall meeting, St. Nicholas Hotel, Springfield, Ill., Oct. 19-20.

• **National Society of Professional Engineers**—Fall Meeting, Hotel Roanoke, Roanoke, Virginia, Oct. 19-20.

• **Pacific Coast Electrical Association**—Hawaiian Conference, Princess Kaiulani Hotel, Honolulu, Oct. 26-27.

• **Kansas Association of Municipal Utilities**—Annual Convention, Wichita, Kansas, Broadview Hotel, Oct. 29-21.

• Additions this week.

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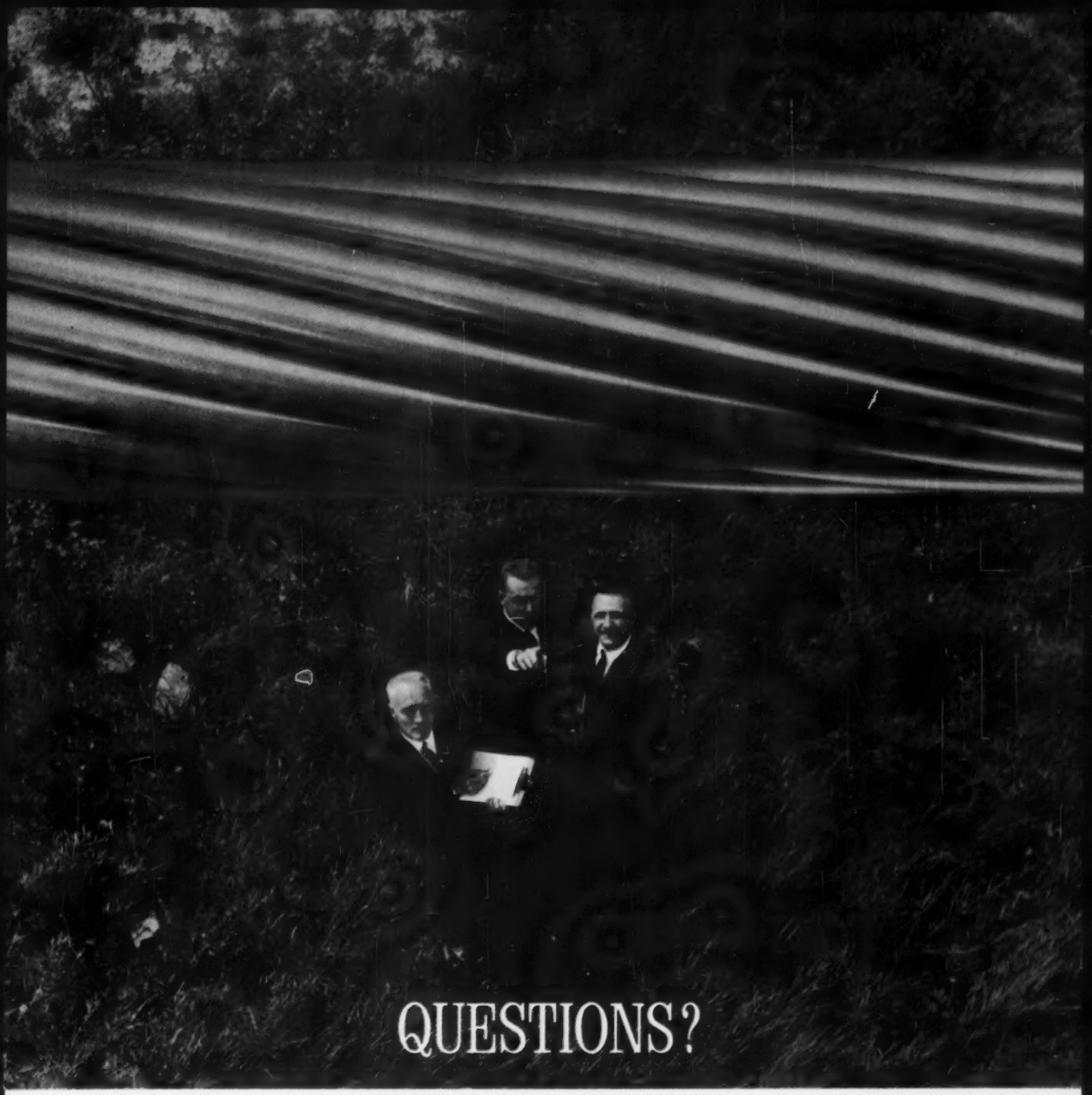

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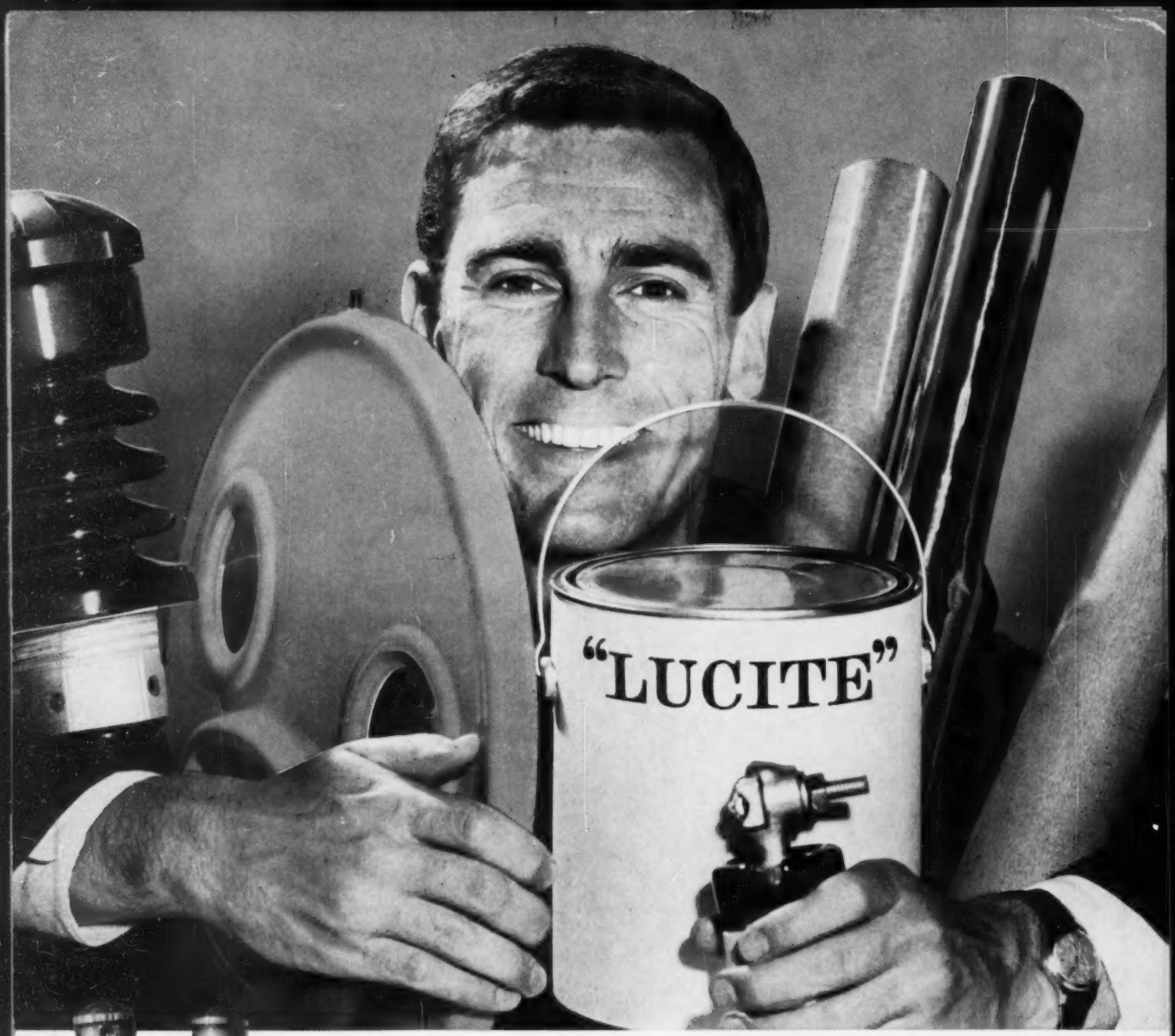

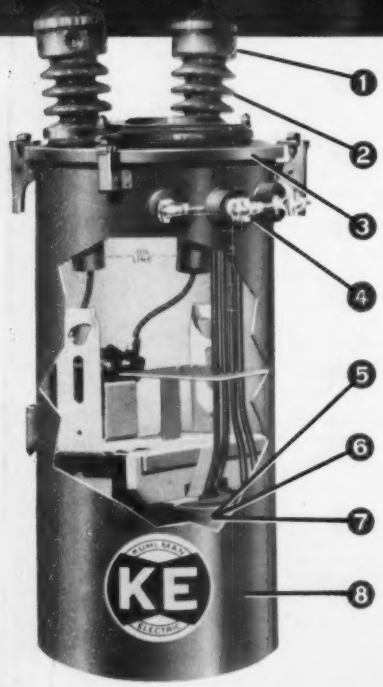

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